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PROCEEDINGS

OF THE

YAL GEOGRAPHICAL SOCIETY.

VOL. XV.

SESSION 1870-71.

Nos. I. to V.

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PROCEEDINGS

OF

THE ROYAL GEOGRAPHICAL SOCIETY.

[ISSUED MARCH 23RD, 1871.]

SESSION 1870-71.

First Meeting, November 15th, 1870.

SIR RODERICK I. MURCHISON, BART., K.C.B., PRESIDENT, in the Chair.

PRESENTATION.—*Reginald H. Prance, Esq.*

ELECTIONS.—*E. B. Evans, Esq.; John Firth, Esq.; C. Edward Habicht, Esq.; Charles Harrison, Esq.; Stanley Haynes, Esq.*, M.D.; *Major-General J. Vesey Kirkland; Lieut.-Colonel G. A. Laughton; P. H. Lawrence, Esq.; Edward Masterman, Esq.; Admiral the Hon. John Spencer.*

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Accessions to the Map-Room since the last Meeting, June 13th, 1870.—The Accessions consist of 48 maps on 95 sheets. The following are the principal, viz.:—Plans of the Peninsular War on 17 sheets. By the War Office, through Sir E. Lugard. Carte Lithologique des Mers de l'Amérique. By M. Delesse. 1870. 10 sheets of the Governmental Map of France, scale $\frac{1}{800000}$, showing the localities of the War. Photozincographed by the Ordnance Survey Office. Presented through Sir H. James, Director. Map of Chili on 8 sheets. Map of the Kingdom of Siam, constructed by the Siamese Government. Scale 1 inch = 13 miles. MS. Map of the Trans-Indus from Skardo, North-Westerly to the Pamir Steppe and the Sources of the Oxus. By G. W. Hayward. 1870. Rio Japura, a north branch of the Amazon. By W. Chandless, Esq. Carte Hydrographique du Département de la Seine. Photo-zincographed by the Ordnance Survey Office. Presented through Sir H. James,

Director. Numerous Maps of the Franco-German War. Published by A. K. Johnston, Jun., E. Standford, and other London publishers.

The PRESIDENT opened the Session with the following Address :—

GENTLEMEN,—Although all meetings of our Society cease during the months of vacation, the progress of Geography is continued by the meetings of the British Association for the Advancement of Science, which take place in the interval, and it was my duty, as President of the Geographical Section of that body, to deliver an address to my associates, assembled at Liverpool, in which I endeavoured to lay before them some of the most recent discoveries. That address, which naturally diminishes the number of new subjects which I should otherwise have now to bring before you, was published at the time, and a number of copies are now laid on the table for the use of those Fellows of the Society who take an interest in them. I may take this opportunity of stating that, during my long experience of the meetings of the British Association, I never attended one of them in which the science of Geography was better upheld than on the occasion of the late meeting at Liverpool, whether we look to the distinguished men who took part in it or to the quality of the Papers which were read and discussed at the sittings.

At that meeting, as I had occasion to state, I looked hopefully to the return to England of that undaunted explorer, Mr. G. W. Hayward, who has been engaged for the last two years, under the auspices of our Society, in exploring Eastern Turkistan and in endeavouring to reach the mysterious and unvisited plateau region, the Pamir Steppe, called by the natives the "Upper Floor of the Earth." You have already had laid before you the record of the labours of this excellent geographer, and you were aware of the serious difficulties he had met with in his endeavours to pass from the north-western boundary of British India towards the Pamir Steppe,—the only route lying through the country of various wild tribes who live in continual hostility with the neighbouring sovereign, the Maharajah of Cashmere. In the spring of the present year he made a preliminary journey into the territory of Yassin, one of these hill tribes, in a chieftain of whom—Meer Wali Khan—Mr. Hayward was unfortunately led to place confidence. His journey beyond this mountain valley towards the Upper Oxus was not then carried out, owing to the mountain passes being at that early season encumbered with snow; but, after visiting Cashmere, he returned to the place after midsummer, in the full confidence of ultimate success.

It is with deep regret that I have to announce that our intrepid and accomplished traveller has been murdered, at the instigation of the above mentioned treacherous chief of Yassin. He was last heard of from the town of Gilgit, on the road to Yassin, on the 5th of July, up to which time his progress appears to have been satisfactory, and he then stated that he was leaving at once for Yassin and Uakhan. Our knowledge of what happened subsequently to this date is derived from two letters, sent by officials of the Cashmere Government to the Maharajah, and by him transmitted to the Lieutenant-Governor of the Punjab. These letters state that the deed was committed about the beginning of August, on the road to Darkote, and that the motive which prompted the chief was the robbery of the traveller's property.

The loss Geographical science has sustained by the death of Mr. Hayward is very great indeed. His fitness for the arduous task he undertook was recognised by the late Lord Strangford and by Sir Henry Rawlinson. It was on the recommendation and under the instructions of the latter that he was entrusted by our Society to explore the remote districts on the threshold of which he has met with a cruel death. I may say, in truth, that he united in his own person all the requisites of a bold and indefatigable explorer with the accomplishments of an accurate observer. He was, moreover, an admirable delineator of the features of the wild mountainous region in which he has travelled, as his coloured sketches have given us ample proof; and his maps of previously unvisited parts of the Himalayan and Kuen Lun ranges, which we fortunately possess, will entitle him to be placed among the most eminent field geographers of this age.

At our last anniversary we rightly awarded to Mr. Hayward our Founder's Gold Medal, and, as the Council were then aware of the great risk he would run in traversing the wild and rebellious district beyond the Western Cashmerian frontiers, we held that if he did lose his life it was our duty to have his name recorded among those who had previously obtained our highest honour. The medal will be presented to his only sister, Mrs. Bell, who is now in New Zealand. In earlier years, Mr. Hayward had served with credit in India as an officer of H.M. 72nd Regiment, and it was then that he first proved his capacity for exploring lofty mountain ranges.

With this deplorable catastrophe the latest journals of Mr. Hayward are unfortunately lost; but we possess a most highly finished map of Yassin and the neighbouring region, drawn from a preliminary general survey which he made earlier in the year, and this,

together with an account of the country, extracted from his letters, will be laid before the Society at the present meeting.

Next in importance to the journey of Mr. Hayward of the present year, was the mission of Mr. Douglas T. Forsyth, to the Ataligh Ghazee, at Kashgar. Concerning the previous labours of Mr. Forsyth, and his preparation for the present expedition, I spoke in my last Anniversary Address, and in the opening Address to the Geographical Section at Liverpool. An instructive letter from this able public servant, written at Shadulla on his return over the mountains, will be read this evening. In it he states that the mission has for the present failed, through the absence on a military expedition of the warlike Ataligh Ghazee. Another letter on this subject will also be read, by which you will perceive that our able associate Dr. Cayley, Political Resident at Ladak, accompanied Forsyth to the foot of the Kuen Lun, and himself made a geographical discovery of some interest regarding the routes over the more southerly range, on his way back to Ladak.

Regarding our explorers in Africa, I have now little to communicate with which the public is not already acquainted. Sir Samuel Baker, now Baker Pasha, is at this moment about to proceed from his station on the White Nile in the Shillook country, south of Khartum, on his way towards Gondokoro.

The causes of the delay his expedition has met with are detailed in a letter to myself, which was recently read to the assembled geographers at Liverpool. From the good organisation which he had established in the mixed forces of soldiers, seamen, and artizans under his command, I augur great eventual success in exploring the great inland sheets of water of Equatorial Africa; whilst he has already given us a striking proof of the promptitude with which he has checked the barbarous forays of the ivory and slave hunters, on the White Nile, by the liberation of some hundreds of wretched captives, who were all speedily restored to their native villages.

Although we are still without any definite intelligence respecting the whereabouts of Livingstone, I learn from a letter of Dr. Kirk at Zanzibar, dated the 29th of August, that a considerable portion of the supplies which he had sent forward must have reached Ujiji, where the great traveller was last heard of. Again, it is satisfactory to be informed that the native traders who have reached the coast still believe in his existence; some saying he had gone to Karagwe, and others that he still remained at Ujiji; and Dr. Kirk was in expectation of receiving direct news by caravans, which were about to arrive from the interior.

Let us hope that before this session closes we may once more

see the handwriting of our undaunted traveller; though, for the reason I assigned in my last Anniversary Address, and again at the Meeting of the British Association, I am persuaded he will never try to return to his home until he has solved the great problem of whether the southern Lake waters, which he has followed up so pertinaciously, do really run into the Albert Nyanza of Baker, and, therefore, into the Nile.

I formerly announced to you that her Majesty's Government had seen fit, on the recommendation of our Council, and through the advocacy of our lamented associate, the late Earl of Clarendon, to send out 1000*l.* to defray the expense of furnishing Livingstone with fresh supplies. I now have the sincere gratification of adding that Mr. James Young had already placed considerable sums of money at the disposal of Dr. Kirk, to provide for and relieve his long-attached friend Livingstone. A fact so highly creditable to this respected Fellow of our Society will, doubtless, be applauded, not only by his associates, but by all the people of the British Isles, who admire the great African Traveller.

Among the numerous papers which will be communicated to the Society during the Session now commenced, I may mention a few which seem to promise a large amount of novelty and interest.

A communication of very great importance is one by our distinguished associate Captain Sherard Osborn, on a subject which he has long studied, and which he intended to have brought before the Meeting of the British Association, had not the terrible calamity of the loss of the *Captain*, bringing with it the loss of friends most dear to him, compelled him to defer it. The paper is entitled 'The Geography of the Bed of the Atlantic and Indian Oceans and Mediterranean Sea, as illustrated with the Diagrams of the Deep-sea Soundings.' In a word, the author reviews all that has been discovered regarding the bed of the ocean, and its relations to general Geography and submarine Telegraphy.

The next is a narrative of a remarkable journey recently made throughout the length and breadth of Patagonia by Lieutenant G. C. Musters, R.N.; a journey which originated in a spirit of adventure whilst he was on half-pay, and led the author to traverse the country, first, from Punta Arena, in the Straits of Magellan, to the River Santa Cruz, thence to the western slopes of the Andes, and the almost unknown region at the head-waters of the Rio Negro. In this remote region he met with various treatment at the hands of the chiefs of the wild Indian tribes, and had opportunities of noting much that will be new in the geographical position of rivers and mountain-ranges in this southern extremity of

South America. Mr. Musters finally made his way to Patagones, on the lower part of the Rio Negro, where he embarked for Buenos Ayres by a sailing-vessel. For fourteen months he was a wanderer in this land of unvarying sterility, peopled by a race of Indians, —those Patagonians, who, by their apparent huge size, so much astonished our early circumnavigators, and who have hitherto been considered as inhospitable as the land they inhabit. Mr. Musters will enlighten us much regarding their stature, disposition, and customs, besides giving us a more complete account of the physical features of the country than has hitherto been presented to the world.

Another communication we have received is one from Governor Weld, of Western Australia, on the subject of an overland expedition from the Swan River Colony to South Australia, which had been successfully carried out between March and August of the present year, under the leadership of the well-known explorer Mr. John Forrest. This expedition originated with Governor Weld himself, in the desire not only to extend the bounds of geographical knowledge, but to open out new routes and fields for Colonial enterprise. The road followed was partly the same as that of Governor Eyre's most arduous journey round the head of the Great Australian Bight; but this expedition appears to have suffered infinitely less than that of its illustrious predecessor.

Amongst the other papers are—one by Mr. Charles B. Brown, of the Geological Survey of British Guiana, on the discovery of a remarkable waterfall of great height (710 feet), in one of the tributaries of the Essequibo River, in that colony. Another by Mr. M. B. Begbie, on the "Benches" or Valley Terraces of British Columbia. Also a short, but exceedingly interesting, communication by Mr. Werner Munzinger, so favourably known for the services rendered to the Abyssinian Expedition, on an excursion into the interior of Hadramaut in Arabia. In short, the subjects already in hand give promise of a Session inferior to none of the preceding in subjects of geographical novelty and importance.

Although not coming within the sphere of our own Geographical work at the present time, I must not omit here to mention the important results of the recent German expeditions in the Arctic regions, a short outline of which has appeared in the 'Geographische Mittheilungen' of Dr. Petermann, to which I may refer for details all who are interested in the subject. One of the results has been the discovery by Von Heuglin and Count Zeil of a large tract of land east of Spitzbergen, extending for at least 60 miles from north to south.

In concluding these few observations, it remains for me to explain to the Society the motive for the change of our apartments, and the acquisition of a new building for our Offices and Library, inasmuch as all this has been enacted during the recess. On my own part, I had long held to the hope that the importance of our Body, and its intimate connexion with nearly all the great offices of the State, together with our publication of many public documents sent to us from these offices, which would otherwise have been ignored, would have induced the Government to provide us with a local habitation, to which I maintained that we had as strong claims as any of the scientific Societies—with the exception of the Royal Society—that are to be located in the new buildings on the site of Burlington House. But, my appeal having met with no success, the Council saw that, as the lease of our present building in Whitehall Place would expire in September next, the time had arrived when it was necessary to expend a large portion of our capital in providing ourselves with a capacious building, in which we might establish permanently that Geographical Map-office, for which the Parliament, as first instigated by Mr. Joseph Hume, did then (1854), and has since his time, granted us the annual sum of 500*l.*

A special General Meeting, therefore, of the whole Society was called, and the suggestion of the Council was unanimously adopted, that the large freehold mansion, No. 1, Savile Row, be purchased for the sum of 14,400*l.* We were led to make this purchase in great measure on account of the close proximity of the building to the new edifice of the London University, the senate of which had most kindly assented to our holding our first year's public meetings in their spacious new Hall; and, although this permission will only be granted from year to year, yet, relying on the former goodwill of that illustrious body, which had for many years allowed us to hold our meetings in the Great Hall of Old Burlington House, now demolished, we may reasonably anticipate that, on our annual application, the same privilege will be granted in future years.

It was, indeed, my belief, until very recently, that this opening meeting would have been held in that Great Hall; but this was rendered impossible, because the gas-lighting apparatus has not yet been completed. Under these circumstances, it became my duty to make such arrangements as were practicable; and if the Theatre of the Royal Institution, in which we assembled last session, had been accessible, I had no doubt that the managers of that body would have willingly allowed us to meet there until the Hall of the London University could receive us. But this was not to be; for

the theatre in Albemarle-street is undergoing interior repair and change.

Recollecting that in the year 1868 we did once assemble in the Theatre of the Royal School of Mines, I directed the issue of the cards of the session with which you have all been furnished; and, subject to the approbation of the Board of Privy Council, under which I serve, I once more greet the Fellows of the Royal Geographical Society in assembling in the establishment of which I am the Director.

The cause of the temporary change of the day of meeting has been explained on each of the cards sent round to the Fellows and in public advertisements. This change extends only to Christmas, by which time, I am assured, the Great Hall of the London University will be at our disposal. I have only further to announce that I trust the fitting up and arrangement of our new building in Savile Row will be completed by the end of the session, so that the transport of our maps and books thereto may be effected during the summer recess. By that time the large new Map-room, to be constructed in the rear of the house, and of which plans have been drawn up in accordance with the views of Mr. James Fergusson, who has taken the most active part in this work, will be completed; and I rejoice to add, that this room can be readily adapted for our ordinary evening meetings, though with some restrictions as to the admission of visitors, if, at any future time, we should find it suitable to meet in our own premises. It is, indeed, a grateful reflection for your old President to have seen the Society so augmented in numbers and popularity as to have accumulated within itself the means by which this stable result can be carried out.

The following letters were then read:—

1. *Letter from* Mr. G. W. Hayward *to* Colonel Showers.

"Camp Roshan, between Gilgit and Yassin,
"17th February, 1870.

"My dear Colonel Showers,

"As you are good enough to take an interest in the exploring expedition to the Pamir, and expressed a wish to hear of my progress to Gilgit, I am glad to be able to let you know that I am on the point of entering Yassin, which place is only some 12 miles distant from my present camp. Some delay was experienced in Gilgit, and an advance to Yassin was for some time doubtful; but at length a favourable answer was received to my application to Meer Wulli Khan, the chief of the country, to be allowed to visit Yassin. He has sent an official to escort me in, and comes out himself to-morrow morning to meet me *en route*. Judging from his letter and friendly expressions, a favourable reception seems certain. He is related by marriage to Amau-i-Moolk, the chief of Chitral, and if I can obtain the latter's good will through Meer Wulli Khan, there should be no great difficulty in penetrating to the Karakul.

Should the Yassin chief further my views, and render assistance as far as Wakhan, it will not be imperative to visit Chitral, since his vakeel mentions a very good route leading direct from Yassin *viâ* the Darkote Pass to Gujal in the basin of the Oxus, thence to Shignan, Roshnan, Derwaz, Kolab, Hissar, and Shahr-i-Sabz. This route entirely avoids Chitral. After crossing the pass at the head of the Yassin Valley, it would appear that one gets into a valley giving exit to one of the branches of the Upper Oxus. A road branches to the east, *viâ* Sarikol, to Yarkund, and the direct road leads down into Shignan. Our maps must be very faulty in their delineations of the country about the Pamir and the junction of the Hindu-Kush and Karakoram chains. The watershed between Wakhan and Sarikol, must be more to the eastward than is represented, for the passes from the head of Yassin and the Gilgit River lead into the basin of the Oxus, and not into the Sarikol district, as Yarkund and Kashgar are more to the eastward than given in our maps, so the eastern crest of the Pamir range should be found to correspond, and I believe it will be found to follow a meridian of about 75° of east longitude. There appears, however, to be no probability of effecting an immediate advance beyond Yassin, as the passes are deep in snow, and will not be open for two or three months. After arranging with the Yassin chief for the onward journey, it will be advisable to return to Gilgit, or perhaps even to Kashmir, until the road is open, for it would be impolitic to linger in such risky ground close to Chitral, the goodwill of whose chief cannot as yet be depended upon.

"Gilgit itself is a place of some 200 houses, situate on the right bank of the river, rising in two branches in the angle formed by the junction of the Karakoram and Hindu-Kush ranges, and joining the Indus near Boonji. It is in lat. 35° 55′ 2″ N., long. 74° 22′ E., and 5025 feet above the sea. The Kashmir authorities have a large fort occupied by some 900 men, commanding the valley, and the Maharajah's territory may be said to end at Gahkuch, some 24 miles beyond, in the direction of Yassin. They are not on the best of terms with the Hunza-Nagar, and Yassin people, whose territories they have several times invaded, but they have invariably been driven back after suffering heavy losses. Hunza itself appears to be impregnable to them on account of the difficult approach through the mountainous country. They have twice attempted it, but have fled back to Gilgit precipitately, and suffered heavily. The Hunza tribe, mustering about 700 to 800 fighting men, successfully defend the narrow pathway and roll down rocks upon their foes. A habitual and constant feud has thus been engendered; for the tribes, being to a man rigid Mahomedans, regard with no friendly eyes the Hindus, to which caste most of the Kashmir troops belong. It is probable that the Kashmir troops will again advance to the head of the valleys, and endeavour to annex Hunza and Yassin, or will have to retire to their natural frontier the Indus. They will hardly be able to hold Hunza should they seize it, for they have tried the onward movement, and have even reached Yassin, but have been driven back after burning and plundering as many villages as they were able.

"The inhabitants of Dardistan, in which may be included Gilgit, Chilas, Hunza-Nagar, Dilail, and Upper Chitral, are a fine good-looking athletic race, and the difference of race is at once perceived on crossing the Indus. Light and dark brown hair, with grey, hazel, and often blue eyes, are seen. The women have a more English cast of countenance than any I have yet seen in Asia. Black hair is the exception amongst them, light-brown locks prevailing. The country, such as is under cultivation, is fertile and productive, but the population is scanty. Pray excuse a somewhat hurried note, as I am much pressed for time, and remain,

"Yours very truly,
"GEORGE W. HAYWARD."

2. *Letter from* Mr. G. W. Hayward *to* Sir Roderick I. Murchison.

"Camp, Yassin, 14th March, 1870.

"My dear Sir Roderick Murchison,

"It is with much pleasure I find myself able to address you from Yassin, which place I have safely reached from Gilgit.

"In order to explain exactly the amount of progress made up to date, it is necessary to briefly mention what I have been doing during the winter months.

"After leaving Kashmir last year, I marched steadily to Gilgit *viâ* Skardo and the Indus Valley. The representations made to me by the Maharajah of Kashmir's officials of the state of the Gilgit frontier, offered little hope of my being able to penetrate to the Pamir Steppe by this route; but arrived at Gilgit, I found matters not nearly so hopeless as I had been led to anticipate. It was at once apparent the Maharajah's officials in Gilgit were anything but pleased at the appearance of an Englishman on that frontier with the ostensible intention of penetrating further, to do which it would be imperative to make friends of the different tribes, their enemies. And in this has lain the great difficulty, —to go through either hostile camp, as it were, and still keep friends with both. I sent presents and a letter to Meer Wulli Khan, the Yassin chief, asking to be allowed to visit his country, feeling sure that if they would but let me come on I should succeed in winning their goodwill. At first the Yassin people were excessively suspicious as to the motives of an Englishman wishing to visit a country where, I believe, no European has ever been before, and no doubt were inclined to connect my presence in Gilgit with some further aggression on the part of the Maharajah of Kashmir. However, the chief decided to let me come; and I can only say that I have been most well received and hospitably treated. I have now just returned from an exploring expedition up to near the Darkote Pass, leading over into Wakhan and the basin of the Oxus, as well as to the foot of the Moshabur Pass leading over into the Mastuch and Chitral valleys. Both passes are choked with snow, and will be impracticable for laden animals for two or three months yet, while the Pamir Steppe itself can scarcely be free from snow until the summer is well advanced, perhaps not before the end of June.

"I may mention my having received two apparently friendly letters from Raja Aman-i-Moolk, the ruler of Chitral, expressing pleasure at my having made the acquaintance of Meer Wulli Khan, the Yassin chief, his son-in-law, and hoping I will visit Chitral, in which case he offers to do his best to forward my onward journey to Badakhshan or Jellalabad. There is reason, however, to be suspicious of the sincerity of his good intentions. The tribes here, —that is the inhabitants of Chitral, Yassin, and Hunza,—entertain the most bitter feelings of enmity against the Maharajah's rule in Gilgit, and the Chitral ruler would probably like to get an Englishman into his power, to be able to play him off against the aggressions of the Dogras in the Gilgit Valley. The Yassin chief, at any rate, has begged me not to think of going into Chitral at present.

"I have explored nearly all the valleys in the basin of the Yassin and Gilgit rivers, and the geographical features which I have already discovered may be said to be comprised in the following details:—

"The watershed between Wakhan and Sarikol, *i. e.* the eastern crest of the Pamir, lies some 70 miles to the eastward of the position represented on our maps, since all the passes at the head of the Yassin and Karambar valleys lead over into the basin of the Oxus, and not into that of the Yarkand River, or the Sarikol district. The Warchagam (or Yassin) River rises in three branches; the most easterly one in the Darkote Pass, the others at the head of the Laspur and Moshabur valleys. Below Yassin the Ghirza River, rising in the Shundur

Pass (leading to Mastuch and Chitral) comes down past Shevare and effects a junction. This stream also receives two considerable tributaries, one from the head of the Swat Valley, the other down the Baltibur Valley, up which lies a route conducting to the country of Tangir. The united stream flows to the E.N.E. past Roshan, and then suddenly turns to the south-east. Above Gahkuch, 40 miles from Gilgit, the Ish-Kaman River joins from down the Karambur Valley, up which, at five days' journey distance, is the most easterly pass leading into Wakhan or the basin of the Oxus. There is a large lake at the head of this valley, called Karambar Sar, which has been formed by glaciers falling and blocking up the bed of the stream. An immense amount of water has accumulated, and the inhabitants of the Gilgit Valley fear that should a very hot summer ensue the lake may burst its bounds, and cause much destruction through the glaciers melting. An inundation from a similar cause took place some nine years ago, and the marks of the devastation then caused are still distinctly visible. The Hunza-Nagar stream joins the Gilgit River four miles below the Gilgit fort. Its two chief branches rise in the Shingshal Pass and at the head of the Garmasai Valley. There are some fine snowy peaks in the Moshabur ridge between the head of the Chitral and Yassin valleys. My measurements of some of them give altitudes of from 21,600 to 23,400 feet above the level of the sea. Our maps mark a town of Kashkar near the head of the Chitral Valley, but there is no such place. The *whole country* is called Kashkar. Yassin, Pouyal, and Mastuch (the districts of) are known as Bura (or Upper) Kashkar; and Chitral as Kuz (or Lower) Kashkar. The position of Yassin itself I have found to be in lat. 36° 22′ 38″ N., long. 73° 35′ 15″ E., and 7765 feet above the sea. The Gilgit Valley varies in elevation from 5000 to 5600 feet. The wheat produced is particularly fine and large grained, while the country is rich in vineyards and orchards of apricot-trees. Ruined villages and waste land, however, meet the eye everywhere,—the unhappy results of the incessant feuds waged between the mountaineers (who are to a man Mahomedans) and the Dogra troops of the Kashmir Rajah. The atrocities practised by the Dogras are a disgrace to a feudatory of the British crown. During their raid into Yassin territory, in 1863, they indiscriminately killed innocent women and children. From 1200 to 1400 of the poor Yassin villagers were massacred by the foulest treachery and cruelty. A few days ago I visited the scene of the massacre, and after the lapse of seven years have myself counted 147 still entire skulls, nearly all those of women and children.

"The River Indus would seem to have a course from 25 to 30 miles more to the northward (than represented on our maps) after turning westward below Boonji and below Chilás. The streams it receives on its right bank are the Kanbari, Dilail, and Tangir rivers; the countries of Dilail and Tangir intervening from Swat to Gilgit. Of these streams the Dilail River is the largest, and joins the Indus some 27 miles below Chilás at Sazeen.

"As the passes leading on to the Pamir cannot be practicable until May or June, I may find it advisable to return to Gilgit and there wait for the proper moment to advance, for a prolonged stay here is, to say the least of it, somewhat risky. The Yassin chief has, however, promised to assist me—will even furnish an armed party to accompany me on the Pamir, should I wish it. I don't think there is any necessity to avail myself of this offer; but loading up provisions here for a three months' campaign should ensure success, as the expedition will thus be independent of the Kirghiz.

"I am very sanguine of being able to thoroughly explore the Pamir Steppe during the summer of 1870, for everything promises well for the eventual success of the expedition.

"I greatly wish to accomplish a journey through, and so home by Russia; but if forced to return, shall still endeavour to regain India by way of Chitral

and Cabul. A visit to Chitral could not fail to be one of great interest. The Yassin and Chitral chiefs claim descent from Alexander of Macedon, through the kings of Khorasan. I am in hopes of being able to procure a couple of Siah Posh Kafirs to accompany me; so, if unable to enter Kafiristan, I still hope to get hold of their language.

"I trust the Geographical Society were satisfied with my former maps and reports, and assuring you no pains or labour shall be spared to ensure success on the Pamir,

"I remain, my dear Sir Roderick Murchison,

"Yours very sincerely,

"GEORGE W. HAYWARD."

3. *Letter from* Mr. G. W. HAYWARD *to* COLONEL SHOWERS.

"MY DEAR COLONEL SHOWERS, "Murree, 27th April, 1870.

"You will be surprised to see from the above address that I am back again in the Punjaub. You will perhaps conclude that I have failed in Yassin; but, on the contrary, everything promises well for the final success of the Pamir expedition. Briefly to explain my presence here, I went to Yassin, was most hospitably received and well treated, and have the satisfaction of having established a friendship with the Yassin people. The courtesy and bearing of the chief, Meer Wulli Khan, was quite beyond what I expected to meet with in Yaghistan. Of course the Kashmir officials were anything but pleased at my success, and secretly did everything they could to prevent my going; but the Yassin chief decided to allow me to visit his territory, and I felt sure that once arrived there I could win his goodwill. Having got the chief on my side is a most important step in my project; and although not all the difficulties, yet certainly one of the greatest has been overcome. While in Yassin I received two letters from Raja Aman-i-Moolk, the Chitral ruler (Meer Wulli Khan's father-in-law), expressing pleasure at my having made the acquaintance of his son-in-law, and hoping I would visit Chitral when the passes opened, in which case he would do his best to further my journey to Badakhshan. Apparently his letter was friendly; but as the Yassin chief begged I would not think of visiting Chitral, at any rate at present, I began to think that Aman-i-Moolk would probably like to get an Englishman into his power, in order to play him off against the aggression of the Maharajah of Kashmir in the Gilgit Valley. I went off exploring and shooting up to the foot of the Moshabur Pass, leading over into the head of the Chitral Valley, and also the Darkote Pass, leading over into Wakhan, the basin of the Oxus; and it was evident the passes would be impracticable for laden animals until June. Thinking it dangerous to linger in such uncertain ground until the passes opened, I made every arrangement for a second visit in May, and, bidding a temporary farewell to my Yassin friends, returned to Gilgit. Most fortunately I did so, for the Maharajah's officials in Gilgit (to serve their own purposes) had caused a report to be spread that I had been plundered in Yassin (mark, I was particularly well treated), and had sent off orders to Astor for the whole of the Dogra forces there (from 2000 to 3000 men) to march at once to Gilgit for the purpose of invading Yassin. My return to Gilgit stopped them, and they hurried back to Astor, but not before I had ascertained the truth of the movement. Comment on such an act of faithlessness would be unnecessary: had they invaded Yassin, such an act would have been fatal to the whole Pamir expedition. The Yassin people could but have connected my presence there with the aggressions of the Dogras. I left Gilgit on the 21st March, leaving my camp, horses, &c., there, and have come down double marches. We were delayed five days the Astor side of the Boorzil Pass, waiting for the weather to clear, but crossed

the pass without any accident, although we had to march waist-deep through the snow for fifty miles. We passed three nights on the snow; and further than suffering from snow-blindness, caused by the intense glare of the sun on the new snow, were fortunate in crossing a pass said to be impracticable until May. I stayed three days in Srinagur, and came down to Murree in four days from there, just too late to see the Viceroy in Rawul Pindee. I have now just returned from Pindee, and, after seeing Lord Mayo here, to-morrow hope to get away for Kashmir at once. I should be back in Yassin, and on the Pamir by the end of June at latest. The Yassin chief has promised to assist me, will even send a party of his followers with me as a protection against the Kirghiz, if I wish it. Loading up supplies for a three months' campaign at Yassin should ensure success, and I feel very sanguine of thoroughly exploring the Pamir during the summer of 1870. It was most tantalizing to get to the foot of the Darkote Pass to know that the commencement of the Bâm-i-Dooneah (Roof of the World) lay just beyond the pass, and to be unable to get there yet on account of the snow.

"I have always been of opinion that the true road from India to Yarkund is from Peshawur *viâ* the Chitral Valley, or from Kashmir *viâ* the Yassin and Gilgit valleys, and not over the Karakoram range. I am more than ever inclined to uphold the opinion since I have seen the excellent road up the Yassin Valley. The geographical features which I have discovered may be said to be comprised in the following details. I have explored nearly all the valleys in the basin of the Gilgit and Yassin rivers, the watershed between Wakhan and Sarikol, *i.e.*, the eastern crest of the Pamir lies from 60 to 70 miles more to the eastward than as given in our map, the passes at the head of the Karambar and Yassin valleys lead over into the basin of the Oxus and not into that of the Yarkund River, or the Sarikol district; the Yassin River rises in three branches, the most easterly one in the Darkote Pass, the other two at the head of the Daspur and Moshabur valleys. Below Yassin the Ghiza River, rising in the Shundur Pass (leading to Mastuch and Chitral), comes down past Shevare; this stream also receives two considerable tributaries—one from the head of the Swat Valley, the other down the Baltibur Valley—up which lies a road leading to the country of Tangir. The united stream flows to the E.N.E., past Roshan, and then suddenly turns to the south-east. Above Gahkuch the Ish-kaman River joins down the Karambur Valley, up which, at five days' journey distance, is the most easterly pass leading over into Wakhan or the basin of the Oxus. It appears there is a large lake at the head of this valley which has been formed by glaciers falling and blocking up the valley. An immense amount of water has accumulated, and the inhabitants fear that should a very hot summer ensue the lake may burst its bounds through the glacier melting, and cause much destruction in the Gilgit Valley. An inundation from a similar cause took place nine or ten years ago, the lake bursting its bounds, and the marks of the devastation then caused are still distinctly visible in the valley. I believe the destruction of the cantonment of Nowshera may be traced to this cause, the water brought down through the Gilgit Valley having flooded the Indus and driven the Sunda River back up its bed. The Indus itself has a course of 20 to 25 miles more to the northward than delineated in our maps: after turning westward below Boonji, the streams it receives between Boonji and Balakote on its right bank are the Dilail and Tangir rivers, which countries lie between Gilgit and Swat; the Dilail River joins the Indus two days' journey below Chilas; the Hunza-Nagar stream joins the Gilgit River four miles below that place, its two chief branches rise in the Shingshal Pass and at the head of the Garmasai Valley. Yassin I found to be in lat. 36° 22′ 38″ N., long. 73° 35′ 15″ E., and 7765 feet above the sea. There are some fine snowy peaks, varying from 21,600 to 23,400 feet above the sea, in the Moshabur ridge between the heads

of the Mastuch or Chitral and Yassin valleys. I have had some capital sport in Yassin. Ibex of 54, 45, and 44 inches, as well as markhor of 56, 52½, and 42½ inches, are the best heads I have secured. The Kashmir shooting cannot be compared with the sport met with across the Indus. The Pamir Steppes swarm with game, amongst which animals the gigantic 'ovis poli,' the largest species of wild sheep in Asia. No European, I believe, has ever killed one. By the way, I met a servant of yours going into Kashmir, and from what he said I presume that you are going on leave again to Kashmir this year. I hope to back there before Mr. Forsyth and Dr. Cayley leave for Ladak. I am afraid the Yarkund trade has been very much exaggerated, and will not fulfil the expectations formed of it. The exports are very insignificant, although the Yarkundies would take Manchester goods in larger quantities from India. I must not forget to mention that Colonel A. Gardner was inquiring most anxiously about his route-map and notes, which he said were in your hands, and hoped I might be able to take some answer about their publication back to him. He is of opinion that the Chang-Chenmo route is a mistake, and a much better road is available by the Chitral or Yassin valleys. After seeing the country, I am inclined to second his opinion. The Yassin route is everything to be desired. There are no difficult passes met with except the Chichilih Pass in Sarikol district, and supplies are everywhere obtainable; but after exploring the Pamir I shall be able to ascertain every detail of this route. Mr. Forsyth, you will be aware, is going to Yarkund. There can be no danger to the mission as long as the Atalik Ghazee is alive and in power, but I doubt the members of the mission being allowed to go about when and where they please. As to going on to Khokand the Atalik Ghazee will not hear of it for one moment. If he would allow exploring, Kashgar would be a splendid basis from which to attack the Pamir. If no disturbances have occurred in Gilgit that now is the best road, but it will be impossible to visit Chitral and the Pamir too. If going home through Russian territory is given up, a return through Chitral might be ventured on; but Chitral, at the best, is dangerous ground: indeed, if the envoy from Chitral has got no satisfactory answer from Colonel Pollock, and has gone back, believing the British Government will not interfere to prevent further aggressions on the part of the Maharajah of Kashmir, it would be folly for an Englishman to enter that country. If I can get on from Yassin and cross the passes with supplies sufficient for the onward journey, I should endeavour to make the Russian frontier; where once arrived, a favourable reception should be a certainty. I must ask you to excuse a hurried note as I am much pressed for time, and

"I remain,
"Yours very truly,
"GEORGE W. HAYWARD."

4. *Letter from* Mr. G. W. HAYWARD *to* COLONEL SHOWERS.

"MY DEAR COLONEL SHOWERS, "Srinagur, 8th May, 1870.

"I have just reached here, and received your letter of the 2nd inst. forwarded from Murree.

"I had a very satisfactory interview with Lord Mayo, and am anxiously awaiting the result of the arrangements with the Maharajah at Sealkote. I am afraid there will be no resident (permanent) in Kashmir as yet, or anything said about giving up Gilgit; but all aggression for the future will, I am sure, be strictly forbidden. By crossing the Indus the treaty of 1846 with the British Government has been most signally infringed. I have written to Colonel Pollock, the Commissioner of Peshawur, to ascertain the result of the visit of the vakeel sent by Aman-i-Moolk, the Chitral chief. It is of vital importance to the success of my expedition, and indeed my own safety, to

know exactly what ideas he went back with. If the Chitral ruler thinks he will receive justice at the hands of our Government in the matter of the aggressions of the Dogras, no doubt an Englishman would meet a favourable reception in Chitral, otherwise it would be folly to enter the country. However, about the letters, as my maps and reports cannot be ready for some days, I should be glad if you would send them at once to Sir Roderick. I am, of course, writing privately to Sir Roderick and Sir Henry Rawlinson, but have some hard work to do yet before my maps and reports are ready. It has been most gratifying to me to hear that the Geographical Society's Gold Medal has been awarded me for the Yarkund trip. By the way, General Kaufman has been instructed to receive me well in Russian Turkistan if I succeed in getting through the 'Terra Incognita' of the Pamir Steppe. Having got the Yassin chief on my side should insure that success. I will write and let you know my exact movements before leaving Kashmir, and in the mean time

"I remain,
"Yours very truly,
"GEORGE W. HAYWARD."

5. *Letter from* Mr. G. W. HAYWARD *to* SIR RODERICK MURCHISON.

"MY DEAR SIR RODERICK MURCHISON, "Kashmir, 21st May, 1870.

"A former letter of mine will have made you acquainted with the fact of my return to Kashmir from Yassin and Gilgit. The abominable treachery and bad faith of the Maharaja of Kashmir's officials in Gilgit rendered such a step on my part positively necessary to insure my own safety. Under the dread of an exposé of the atrocities they have committed across the Indus, the Dogra officials had evidently planned a systematic scheme to injure me and mar the success of my expedition. Thinking I was still in Yassin and sure to have become acquainted with all the facts of their misdeeds, or perhaps imagining I had been enabled to go on and cross the passes into Chitral or Wakhan, they caused a report to be spread that I had been plundered in Yassin, and, *professedly* to aid me, were on the point of again invading that territory, when my unexpected return to Gilgit arrested them.

"I had been more than suspicious of the sincerity of their goodwill, and when I found the passes beyond Yassin were closed by the snow, and likely to be impracticable for some months, I at once decided to return to Gilgit and wait for the proper moment to advance. My sudden return fully exposed the intentions of the Dogra officials. The treachery they meditated was so palpable as to be quite unmistakable. An invasion of Yassin whilst I was in that territory could not have been otherwise than fatal to the whole of my party, for the Yassin chief and his followers would instantly have connected the aggression with my presence there, and in the heat of the moment would have vented their indignation and anger on myself and party. Leaving my camp in Gilgit, I hurried down to Kashmir and the Punjab for the twofold purpose of making every arrangement to avail myself of the favourable opening to the Pamir Steppe offered by means of the friendship established with the Yassin people, and of representing the facts I had become acquainted with. I have accordingly sent off baggage-animals and supplies for a summer's campaign to Gilgit, and am following myself in a few days. I hope to reach Yassin in 22 days from here, and should be on Pamir Steppe in five weeks from date.

"I regret, however, to have to tell you that a letter of mine representing the atrocities committed by the Maharaja of Kashmir's troops in the countries across the Indus, with an account of their massacre of the Yassin villages in 1863, and certain comments and opinions expressed thereon, has been pub-

lished in the 'Pioneer' newspaper of May 9th. The publication of this letter is most unfortunate; and likely to interfere very much with the objects I have in view. I extremely regret that the editor of the paper in question should have thought fit to publish this letter, and the publication of it has been entirely in opposition to my wishes and instructions, while certain comments in the letter were never for one moment intended to be published in the form in which they appear in the 'Pioneer' of May 9th. The resentment aroused amongst the Maharaja's officials is very great, and it cannot be doubted they will in every way *secretly* strive to do me harm.

"Still, in the interests of geography, I feel myself bound to persevere in the enterprise; and, notwithstanding I have been strongly advised to postpone my journey, I am very loth to think of allowing myself to be diverted from the undertaking by any increased danger incurred through the resentment of the Kashmir Durbar.

"In order, however, to relieve the Royal Geographical Society from a shade of responsibility on my account, I deem it right to offer to sever all connection with the Society during the expedition I am contemplating; and though the severence of a connection so auspiciously begun will be a source of the profoundest regret to me, I am aware that before I left London it was distinctly understood that this exploration was undertaken solely at my own risk and on my own responsibility.

"However, all things considered, the prospect of success looks very fair indeed, after I shall have once reached Yassin again. Whatever resentment the Kashmir Durbar may entertain, the very fact of its being known should prove my greater safety; for the Maharaja is thus, as it were, responsible for the safe progress of the expedition.

"I am the more unwilling to give up the enterprise from the mission of Mr. Forsyth to Yarkand; as, if able to open out the shortest and best route from British territory into Eastern Turkistan—that from Peshawur *viâ* the Chitral Valley and the Pamir Steppe—it will undoubtedly be a great step, and it is for the sake of the scientific and geographical information expected as the result of my journey that I have determined to adhere to my original purpose.

"Forewarned in this case is forearmed, and, notwithstanding all there will be to contend with, I firmly believe that (D.V.) success will ultimately attend my efforts, and carry through the enterprise in safety to the end.

"I remain yours very sincerely,

"George W. Hayward."

Sir Henry Rawlinson, at the invitation of the President, rose and addressed the meeting as follows:—

Sir Roderick, the last time that I had occasion to address you on the subject of Mr. Hayward was under very different circumstances from the present. I then had the honour of accepting from your hands, on his behalf, the Founder's Medal of the Royal Geographical Society, which had been awarded to him by the Council for his great services to geographical science in his journey to Yarkand and Kashmere, and his discoveries and surveys in the Karakoram and Kuen Luen Mountains. As far as I remember, I then described Mr. Hayward as a young man, in the full vigour of manhood, proud of his past honours, full of high hopes for the future, starting on his daring enterprise to explore the Pamir Steppes, resolved to achieve success, and with every prospect of that success before him. Now, all is changed. Mr. Hayward lies cold in death: not on the battle-field, not in Christian or hallowed soil, but under a heap of stones, on the bleak hill-side, near the crests of the Indian Caucasus, the victim of a barbarous, cold-blooded

murder. It is hard to speak coolly on a subject of this sort; it is difficult to trace with judicial care the causes which have led to such a lamentable event. I know it has been said that Mr. Hayward was wanting in discretion, in caution, in regard for his own personal safety. All that may be admitted. Disregard of his personal safety was an essential point in his character, and it was one of his chief qualifications as an explorer in unknown and savage regions. If he had his faults—and I do not dispute that he had them—he has dearly paid for them: and I think it now becomes us to remember him not as an incautious traveller, but rather as a high-minded and determined man, a skilful draughtsman, a first-rate observer, one who was gifted with indomitable energy, courage, and perseverance, one who was impelled by a sense of loyalty and by an honourable ambition to achieve the object before him. I think it is our duty to remember also the great services which he had already performed to geography, and, above all, his sad and untimely end in the cause of science and the path of duty. The universal press of India has paid its tribute to Mr. Hayward, and I would wish his merits to be appreciated by this Society, and in this country as well as in the East. I will read one brief paragraph from an Indian paper, which will show the opinion entertained of him in India. It was the first notice of his certain death, and appeared in the 'Friend of India:'—

"It is now clear that he was stoned to death, with several of his friends and followers, about a day's march on the other side of Yassin; and there is no doubt that the murderer is the man who was lately chief of Yassin, and whom our brave and unfortunate countryman defended so stoutly and strove so hard to befriend. We have more to hear yet of this Mir Wulli—scoundrel! —more to hear yet of how poor Mr. Hayward died. The latter is, certainly enough, gone to the great silence, and gone with his foot to the last on the path of duty. Such a death breeds heroes, but such a murder should bring down penalties on the head of the murderer. We hope that Government will now do its duty, as Mr. Hayward did his."

Now, if the meeting would desire to hear, as I believe they will, some particulars of Mr. Hayward's death, I have the papers with me which give the most authentic details we are in possession of, and, with your permission, I will read some extracts. I wish, in the first place, to correct an impression which the meeting might entertain of the complicity of the Cashmere Government in this affair. I can assure the meeting that, as far as I have the means of judging, there is no foundation whatever for that impression. It is clear that Mr. Hayward's letter, which was published, very unfortunately, as I admit, had nothing whatever to do with the circumstances of his death; nor has there been an indication on the spot of anything but the most loyal conduct on the part of the Government of Cashmere. I think it only proper, in justice to the Maharajah, that this should be publicly stated at the commencement, because there was a *primâ facie* suspicion that his death might have been owing to the underhand intrigues of the Maharajah's officers, in consequence of the publication of that letter. It must be further seen that if the publication of that letter had really led to Mr. Hayward's death, there would naturally have been a most unpleasant feeling as regards the gentlemen implicated in that publication. But it is now quite clear that the two circumstances are entirely disconnected. It is hardly necessary that I should dwell in detail on the early part of Mr. Hayward's journey. His own letters have sufficiently explained that he penetrated into Gilgit and Yassin, in February and March; but found himself unable to cross the mountains, owing to the snow and the severe climate, and accordingly returned to Cashmere. From Cashmere he again entered the mountains in June and July, and there he met his unfortunate end. There has been a good deal of investigation, which is not yet concluded, as to the particulars and manner

of his death; but the most important evidence that has come before the Government, is given by a servant of the ruler of Yassin. A few words on the political and geographical position of parties in these mountains seem here to be necessary. There are two great valleys in those mountains,—the Chitral Valley running west, and the Gilgit Valley running east. The Chitral Valley is entirely independent of Cashmere, as is Yassin also, which is the upper continuation of Gilgit. It is only the lower or Gilgit valley which is subject to the Maharajah. In the Chitral Valley the Governor is Aman-ul-Mulk. The Governor of Yassin, Meer Wali, the murderer of Mr. Hayward, is a nephew and son-in-law of the Chitral Chief. These are the two people principally concerned. When Mr. Hayward, on his last journey, came to Yassin, Meer Wali was in command. We have not yet the details of the interview which took place between Meer Wali and Mr. Hayward; but I suspect, from many circumstances, it was not satisfactory. There was a sub-governor of Yassin, under this Meer Wali, of the name of Wuzeer Rahmat. This man was evidently a great friend of Mr. Hayward's, and Meer Wali was jealous of this friendship. So far is quite certain, and I attribute the unfriendly feelings of Meer Wali to Mr. Hayward, in a great measure, to the jealousy which he thus entertained of his own Minister. I will now read extracts from the official evidence :—

"They stated that when the Sahib came to Yassin on the first occasion he gave liberal presents both to the Rajah and the people of Yassin territory, and every one was pleased with him. But when he came the second time he did not pay any attentions either to the Rajah or the people, and prepared to go away to Badakhshan. He asked for twenty-five porters, and was told in reply that porters were scarce in the country, the people of which were generally very respectable, and he could not be accommodated with so many porters. The Sahib then said sternly, and in harsh language, 'Why do you get annoyed at being asked to furnish only so small a number of porters? When I return from Badakhshan I shall have a numerous party of Pathans with me, and a large number of porters will be required. How will you manage then?' When the people heard these words they were exasperated. They said, 'At present we are not the subjects of any one, and we are spoken to in such harsh language. When the Sahib returns with a force from Badakhshan, we shall have no homes left to live in.'"

That, of course, is mere gossip. I do not suppose any little dispute about porters could have led to such serious consequences; the motive power came, no doubt, from the chief.

"When Meer Wali heard what the Sahib had spoken, he assured the people and the elders that they need not distress themselves, as he had determined to get rid of the pest, *i. e.* to kill him, and would on no account let him live. He then told the people to furnish the gentleman with as many porters as he asked for, and to convey him as far as Darkote, on the Kuchal road, in the jungle. He would then take measures for killing him there. Accordingly, porters were furnished to the gentleman, and, after the latter had left, Meer Wali sent off the following men: Mahammad Rafik, Sharif (his confidential agent), Shahdil Aman, Razadil Aman, and twenty others. On the way these men learned from some of the porters who were returning after leaving their loads that the gentleman was telling his servants that he anticipated mischief from the people that night, and that they should prepare themselves to guard against it. Subsequently the gentleman had both his tents pitched, loaded his pistols and rifles, lighted candles, and sat up all night. The people seeing the Sahib on his guard, and dreading his firearms, concealed themselves. Early in the morning the gentleman and his servants were overpowered by sleep. The men now emerged from their hiding-places. Kollour and Shahdil Aman entered the tent, caught hold of the gentleman by the neck and dragged

him out of the tent. During the struggle he asked them not to kill him, and told them he would give his own weight in gold and jewels if they spared his life. But the wretches were inexorable. They fastened a rope round his neck and dragged him away to the jungle, where they stoned him to death. The murderers then carried away the gentleman's property and his servants to Yassin, and confined the gentleman's munshi in the fort. Of the property which was seized, Meer Wali gave away the cloth, &c., to the principal men and his own servants, and appropriated for himself the fire-arms and the cash."

When intelligence of this reached Chitral, the Governor, Aman-ul-Mulk, immediately sent to punish Meer Wali. He appointed another nephew, Pahlewan—whose servant makes this statement—governor of Yassin, and on his arrival Meer Wali fled.

"When the report of the approach of Raja Ghulam Mohi-ud-din's (otherwise called Pahlewan) forces arrived and Meer Wali fled, he carried away the munshi, who was confined in the fort, and killed him at the same place where the gentleman had been killed. His body is lying there. Such is the account which was given by the people to Raja Ghulam Mohi-ud-din. This account was given by Wazir Rahmat to Raja Ghulam Mohi-ud-din, and I was present at the time. Only the following articles are lying in the fort: two chairs, a clothes-box, some papers in a box," which we hope will still be recovered. "The remaining property has all been taken away by Meer Wali. The body of the gentleman is lying under the stones. The bodies of the five servants are lying where they were killed. None of them have been interred."

In answer to the question, "How many servants were with the gentleman?" the witness answered, "Five."

That is all that is important in the deposition of the confidential servant of the man who was sent from Chitral to replace the murderer. No doubt the first feeling which arises in all our breasts is the hope that vengeance may overtake Meer Wali. All I can say is, that the mark of Cain is on that man. He is doomed. Whether he will meet with his death from us, or in the wild fashion which prevails in those countries, it is impossible to say; but from the day he committed that murder he has never known an hour's safety. Immediately the information reached Chitral, forces were sent by his own uncle to drive him out of the country as an outcast. He fled at once, taking the moonshee with him, and, passing by the place where Mr. Hayward was killed, he had the moonshee also put to death there. He then escaped across the mountains into the valley of the Oxus. There he was seized, and sent back a prisoner to Chitral. The chief at Chitral said, "This man is my sister's son: I cannot give him up to be executed, but he shall not remain here;" and he drove him out of the country. Meer Wali then tried to take refuge in Cabul, but was refused an asylum; and he again entered the Chitral Valley, where, by the last accounts, he was hiding from the officers who have been sent to seize him. Depend upon it, the man is doomed, and cannot possibly survive; in fact, according to all reasonable probability, he has suffered the extreme penalty before now.

The PRESIDENT: To what motives do you attribute the murder? This man had received Hayward at first with the greatest kindness, and he was induced to go into the Great Pamir Steppe entirely through his confidence in this Meer Wali. What was it that turned him?

SIR H. RAWLINSON: It is a point which is still unknown; it can only be guessed at.

The PRESIDENT: You have entirely exonerated the Government of Cashmere; but there are persons, and I hold a letter in my hand from one, who still have their doubts about it.

SIR H. RAWLINSON: I can only say that in none of the letters or deposi-

tions can I find a trace of anything like complicity between the officers of the Maharajah and the local chiefs. Meer Wali, on the first occasion of Hayward's visit, was certainly very friendly to him; he also knew, I suppose, that Mr. Hayward had incurred much odium with the Seikh Government for having incautiously published a rather exaggerated account of the ill-doings of the Maharajah's officers many years before, and this ought to have still further cemented their friendship; but from some cause or other there certainly was distrust between them on this occasion. Perhaps Meer Wali suspected Hayward because he had gone away, and had remained two or three months in the confidence of the Cashmere officials. He had resided, indeed, during the months of May, June, and part of July, in Srinagur, was sent back with an escort of Sikhs, was received in Ghilgit in a friendly manner, and passed on into Yassin as the guest of the Maharajah. Meer Wali, then, may have become suspicious of him on this account in the first instance. Hayward also struck up a friendship with the Minister who was in disgrace with his master, and this may have been an additional cause of suspicion. The property, again, was an incentive to plunder; for, according to the depositions, Meer Wali did plunder the property, and I think the man's cupidity was probably the strongest of all the motives which led to this unfortunate affair. At all events, I repeat that there is not in the evidence we at present possess the slightest indication of any complicity either on the part of the Maharajah himself or of any of his officers in Mr. Hayward's murder. Mr. Hayward has done us immense service. He has not merely mapped little valleys here and there, and traced the courses of hitherto unknown rivers, but he has ascertained from personal observation what are really the great lines of communication between India and Central Asia. I have always been satisfied that the time will come when Thibet will not be the line of communication. I do not believe that there ever can be any great thoroughfare over passes of 20,000 feet, or more. The real line of communication between India and Turkistan is by the Chitral Valley. That is an open road, with no passes of any great height, and practicable throughout to wheeled carriages; and there is no sort of reason why, in order to protect trade, there should not be a line of posts from Peshawur to the valley of the Oxus. It is not nearly as difficult a country to pass through as the Kyber Pass, and it is, moreover, the direct road from India to Central Asia. Mr. Hayward has done good service in pointing this out, and he has also the credit of having pointed out another line, on the eastern side, by the Yassin Valley. He was not aware that in antiquity this was the very line by which the famous Chinese pilgrim Fa-Hian entered India. But so it was. The great Chinese traveller crossed the mountains from the valley of the Oxus by the Darkote Pass, near which Mr. Hayward was murdered, descended the upper Yassin Valley, and then passed over into *Tho-li-lo*, or *Dilail*, where he found the colossal image of Buddha, subsequently following down the Swat Valley to Peshawur. We thus see that in ancient times, as at present, there were two lines leading from the Oxus to India: one by the Chitral Valley, and the other by Yassin, Dilail and Swat. I am proud of having first brought Mr. Hayward to the notice of the Society, and of having helped him on this expedition. Of course, I have felt the most bitter disappointment and pain at the result. All I can say further is, that as Mr. Hayward has died in the path of duty, I think all honour is due to him from our Society.

The PRESIDENT said in one of the last letters Mr. Hayward wrote, he expressed the greatest gratification at having been made acquainted with the fact that the gold medal of the Society had been awarded to him. The Council adjudicated the medal to him in the full belief that he would have to encounter the greatest difficulties in order to get through this region in which he had lost his life. It was satisfactory to know that the Cashmere Govern-

ment was not in any way implicated in the murder, though at first suspicion naturally fell upon them.

The following letters were afterwards read:—

Letter from Mr. Forsyth *to* Sir Roderick I. Murchison.

"Dear Sir Roderick, "Camp, Shadulla, 19th Sept., 1870.

"You will be anxious to hear what the Yarkand expedition has done in behalf of the Royal Geographical Society.

"The absence of the Atalik Ghazee from Kashgar has compelled me to return without effecting all the objects for which I was sent; but the opportunity of a second visit has been turned to good account by Mr. Shaw, who has been indefatigable in taking observations and determining accurately the position of several important places. I will not give secondhand any information which he will impart to you, but will merely put before you the result of my own inquiries.

"I had hoped to make great use of Major Montgomerie's Pundit, but unfortunately it was not perfectly understood at the outset that he was to preserve a strict incognito, and when he joined my camp in Ladakh it was announced that he was a surveyor sent by the Government to survey all Yarkand. Now the Yarkand Government, though willing enough to be friends with us, was not quite prepared to admit a flood of European civilization; and to the Asiatic mind a survey is only preliminary to the advance of an army. I had therefore to send the Pundit back to India at once.

"However, in spite of this drawback, I think I have made some advance in our geographical knowledge, or, at all events, am able to put others better qualified than myself on the scent.

"I mentioned in a former letter that Marco Polo speaks of Charchan, regarding the locality of which I could find nothing in any map or modern work. He also speaks of the province of Peyn, Lop, Tangut, &c., regarding all which places our knowledge is very deficient. I will now give what I have gleaned on the subject. There is a town called Charchand, situated about 450 miles, or 30 marches, east of Khoten. The road to it skirts the foot of the Kuen Luen Range, which by all accounts, and certainly so far as we could see from the heights of Linzi Thung, extends far to the east, thus dispelling the notion that a cart-road could ever be found from Khoten to Ghartokh. Charchand is a town of some size, perhaps it has 8000 or 10,000 inhabitants, and lies in the gorge of one of many ravines on the north side of this range. There is said to be abundance of grass on the mountain-slopes, similar, I presume, to what we have observed on the slopes in Yarkand territory. Twelve rivers flow from the mountain-range to the north, and uniting, are said to form one stream and flow into Lake Lop. There was formerly, and possibly may still be, communication between Charchand and China. Merchants travel between Charchand and Khoten. Charchand is famous for its precious stones. The inhabitants are said to be Mahommedan. All this agrees with Marco Polo. In a note to Wright's edition of Marsden's translation of 'Marco Polo,' it is said that the position of Charchand 'seems to be that of Karashar. De Guignes speaks of a district named Char-chen, to the south of Hami, and near the Lake of Lop, which can be no other than this.' I should be disposed, for the reasons already given, to place Charchand about 87° E. long. and 37° N. lat.

"Next as regards the province of Peyn. For a long time I could get no clue to this, till one man, speaking of the rivers which flow near Charchand, said they went into the *Pain Mulk* or lowlands. This at once struck me as the solution, not only of this doubtful point, but also of another which I will

presently mention. In the notes to the same edition of 'Marco Polo' the word Peyn is also given as Poim or Poin. Now Poin is in the broad Andijani dialect for Pá-een. I asked my informant, who spoke this dialect, and who had travelled from St. Petersburg to Orunchee, and from Siberia to Khiva, whether this 'Pain Mulk' was inhabited. 'Not now,' he said. Formerly there were cities, but they have been buried by the sands of the desert. One of these cities, about seven days' journey from Khoten, is mentioned by Johnson, and my informant told me he had been there and had seen ten dug out of the ruins and brought for sale in the market of Yarkand. Takla Makan is, in fact, only another name for Marco Polo's province of Peyn.

"This leads me to touch on another point, the identification of *Bolor*. Colonel Gardiner, whom I met at Srinagur, said Bolor was nothing more nor less than 'Bálá,' High (land): Bala is the Persian for high (or height, 'bálái'). I did not at the time push the subject with him; but, on meeting with an Andijani Tajík, who had been sent to escort us from Sanju to Yarkand, I observed that in his broad dialect he pronounced the word Bala as 'bolor.' Now if Marco Polo's Pegn means 'low land,' his Bolor may mean 'high land.' This, I confess, is more natural to my mind than making Bolor a corruption of 'Belut Tagh.' But does my supposition help us to fix the locality of Bolor? Marco Polo gives this name to the region over which he passed for 40 days after crossing the Pamir, and before he reached Kashgar.

"All this country is, according to Colonel Gardiner, 'highland,' and called 'Bálá Mulk,' or, as pronounced by my Andijani friend, 'Bolor Mulk.'

"As regards the desert of Lop, that undoubtedly is what we know as the desert of Gobi; and all the same stories told by Marco Polo, of evil spirits and strange noises, were retailed to me by my informant. There were cities on the edge of the desert, which have been destroyed by the sands. The people who live on the borders of Lake Lop are said to live on fish, and are dressed in garments made from the bark of trees. This betokens the vicinity of forests of some kind; but on this point my information is not reliable.

"Tanguth is a name still known, and is applied to the country about Karashahr. On this point, however, Mr. Shaw has made inquiries, which I leave him to communicate.

"I think the population of Yarkand has been put at far too high a figure, as 120,000. I should say that 40,000 was the very outside number. Karghalik, which, I believe, has been credited with a population of ten or twelve thousand, has, I should say, at the very utmost, 3000. I have invariably noticed that numbers are greatly exaggerated by natives, and often enough by Europeans.

"I am very sorry we were not able to reach Kashgar; but some future envoy will, I trust, be more fortunate, and will send you more valuable information than I, with my limited opportunities and powers, have been able to give."

Letter from Dr. Cayley *to* Sir Henry Rawlinson.

"My dear Sir Henry, "Lé, Ladák, 20th Sept., 1870.

"You may be interested to hear the latest news of the Mission to Yarkand, sent this summer by Lord Mayo, in return for the visit of the Atalik's envoy, Mirzi Shadi, who came to India last winter, and went to Calcutta to prefer his master's requests with the Viceroy.

"The Yarkand Expedition, consisting of Mr. Forsyth, Dr. Henderson, and Mr. Shaw—the latter joining the party in Ladák early in July, after a very rapid journey from England—accompanied by Mirza Shadi and Yakúb Khan, brother-in-law of the Atalik, after many delays in Cashmere, passed through

Ladák early in July. I accompanied them as far as the Changchenmo Valley, and then went on ahead by a different route, in order to explore the upper, southern, branch of the Karakash River, discovered two years ago by Mr. Hayward, and see if an easier and shorter route could not be found leading to Shadula, the frontier fort of Yarkand. I rejoined the Yarkand party on the Karakash, four marches above Shadula. After I left them, Forsyth's camp met with what might have proved very serious disasters on the road. The Wazir of Ladák went with the camp as far as Changchenmo, and then said that everything was ready, and Forsyth started on the 2nd March from Changchenmo. Just at the worst part of the road, where there is no grass, he found that no barley had been sent for the horses, and the wretched animals, originally quite unfit for the journey, died wholesale. In three days they lost nearly a hundred ponies, and very nearly had to turn back; but, by leaving half the camp behind, Forsyth was able to push on, and reached Shadula all right. A few days later, when too late, the Wazir sent on no end of yaks laden with grain, and, as a matter of course, a great number —some two or three hundred—died on the road; yaks being quiet unsuited for that kind of journey.

"We reached Shadula on the 5th of August, and there heard for the first time that the Atalik was absent, with all his forces, on a hostile expedition against the Tunganis in Kuchar and Turfan; and, it was said, as far as Orumchi. This news had been so carefully suppressed, that in Ladák nothing was known of it, or Forsyth would not have gone on. Only one man had reached Ladák since the winter, and he did not breathe a word of any disturbance having occurred; but said the Atalik was at Kashgar, as usual. None of the merchants were allowed to start until Forsyth reached Yarkand territory, and, though several of them had tried to send letters to me in Ladák, the messengers were all stopped on the road. The man who did come over, and brought letters from the Dád Khwáh of Yarkand, of course told the envoy Mirza Shadi; but he kept it dark. He is a typical Andijani at telling lies. At Shadula he assured Forsyth that the Atalik was on his way back, having destroyed all his enemies, and would be in Kashgar in a few days, though this was all false.

"The course of events in Yarkand during the last few months has been as follows:—Early in March last all the available troops in Yarkand, Khotan and other places were ordered to proceed in haste to Mural Bashi, five stages east of Kashgar, where the Kashgar troops had already gone, and a few days afterwards the Atalik himself joined the army. This was on account of some intelligence received from Aksu and Kuchar. After reviewing the troops at Mural Bashi, the Atalik distributed pay, clothing, &c., and marched on to Aksu six stages. Here there was a little fighting, the people of the city having a plot formed in Khotan among the Mullahs to raise a revolt and seize the fort, but the outbreak was at once put down and a few hundreds executed.

"On my return from Shadula I followed an entirely new route for great part of the way, and which turned out by far the shortest and best route in every way between the Changchenmo Valley and Shadula. From the latter place I crossed the mountain range south of the Karakash, and then traversed the great Maliksha Plain, lying between that range and the Karakoram, to its south-east corner, where I found a very easy pass into the basin of the Upper Karakash. I then followed up this river for two marches to Kiziljilga (see Hayward's map), and from there continued south up the main branch of the river to where it turns due west, and from thence I crossed two easy passes, with a plain of about 10 miles across between them, into the Changchenmo watershed. The distance from Maliksha to Gogra, in Changchenmo, was nine easy marches, generally along sheltered valleys, and only at one halting-place was there no fuel and grass. Almost everywhere along the whole road they

were most abundant, and water was most plentiful the whole way. I think Forsyth will return by this route, and I have sent men to show him the way. None of the maps of the country are quite right. Hayward's is nearly so, but he did not follow up the Karakash above Kiziljilga, and between that point and the head-waters of the Changchenmo the country has never been regularly mapped; but I hope to have a correct map of this region ready in a short time.

"There is a report here which came from Cashmir that Hayward has been murdered in Chitral. It is a mere rumour, and very likely entirely false and without foundation; and I heartily hope it is. I have written to Cashmir to try and find out if anything has been heard there. I hope his friends may not hear of it, should it be false. I cannot help feeling anxious, as he had with him a good deal of property, and the people of those regions do not much regard human life.

"Believe me yours very truly,
"HENRY CAYLEY."

Second Meeting, 29th November, 1870.

MAJOR-GENERAL SIR HENRY C. RAWLINSON, K.C.B., VICE-PRESIDENT, in the Chair.

ELECTIONS.—*Sir Henry Barkly*, K.C.B. (Governor of the Cape); *Julius Beer, Esq.; E. Clapton, Esq.*, M.D.; *Edwin Fairland, Esq.* (Surgeon 21st Hussars); *Andrew Grant, Esq.; F. H. Gottlieb, Esq.*, J.P.; *G. N. Hooper, Esq.; Lieutenant T. M. Hitchins, Esq.*, R.A.; *John B. Harbord* (Chaplain R.N.); *Rev. R. P. Hooper; Captain A. F. P. Harcourt; Captain Thomas Jessop; Henry S. King, Esq.; George Lyall, Esq.* (Deputy-Governor of the Bank of England); *George Latham, Esq.*, C.E.; *Lord Lindsay; A. L. Leveret, Esq.; L. Mariani, Esq.; Lieutenant A. MacLeod*, R.N.; *John Macturk, Esq.; W. C. Martin, Esq.; H. John Nicoll, Esq.; Samuel Nash, Esq.; James Nichols, Esq.; Sir Thomas Pycroft*, K.C.S.I.; *C. M. Poole, Esq.; W. S. Parfitt, Esq.; Hon. W. C. F. Robinson* (Governor of Prince Edward's Island); *William Rice, Esq.; George E. A. Ross, Esq.; Rev. Thomas Ratcliffe; Lieutenant Henry Stanley*, R.N.; *W. A. Sanford, Esq.; Major-General H. B. Turner; J. W. Trutch, Esq.* (Chief Commissioner of Lands and Works, British Columbia); *Frederick Wilder, Esq.; Sir Philip Wodehouse*, K.C.B.

ACCESSIONS TO THE LIBRARY FROM NOVEMBER 15TH TO 29TH.—'Memoir on the Gold Coast.' By B. F. Murphy. 1831. Donor W. D. Cooley, Esq. 'Memorandum on the Survey of Architectural and other Archæological Remains in the Bombay Presidency.' By J. Burgess. 1870. Donor the author. 'Ferrovia Tramsandina.' Per Emilio Rosetti. Buenos Aires, 1870. Donor the author. 'Education and Status of Civil Engineers.' Donors the Institution

of Civil Engineers. 'A Ramble in the New Zealand Bush.' By Stanley L. Haynes. 1870. Donor the author. 'Denkschrift auf C. E. H. von Meyer.' Von C. A. Zittel. Munchen, 1870. Donor the author. 'Relacion de la Expedicion a el Reyen el Chaco.' Rosano, 1867. Donor W. Bollaert, Esq. 'Viage a las Cordilleras de Talca i de Chillan.' Per D. Ignacio Domeyko. 1849. Donor W. Bollaert, Esq.

ACCESSIONS TO MAP-ROOM SINCE THE LAST MEETING OF NOVEMBER 15TH.—Map of Stanley Harbour, Falkland Islands. Presented by F. Coleman, Esq., Secretary to the Falkland Islands Company. Map of Alsace and Lorraine, showing the distribution of the French and German languages. Presented by Dr. A. Petermann. Map of the World, exhibiting the Isothermal Zodiac, or belt of equal temperature round the Northern Hemisphere.

The CHAIRMAN, before the commencement of the ordinary business, said that the Fellows of the Society, one and all, must have received with feelings of the deepest pain the intelligence of the serious illness of their veteran leader, Sir Roderick Murchison. The bulletin which he had received since he entered the building gave a somewhat more cheering account than had been issued during the last few days; yet there was still abundant cause for anxiety. The Council of the Society over which he (the Chairman) presided a few hours ago, considering the gravity of the circumstances, had thought it proper to pass a resolution, expressing the feelings of deep sorrow with which they had heard of Sir Roderick's illness, and also their earnest hope for his recovery. He could not help thinking that it would be gratifying to the feelings of their excellent President if the meeting which he now addressed were also to empower him to express the same sentiments to Sir Roderick's relatives. He would only further say that this was not the time or the place to enter into a retrospect of Sir Roderick's great services to the cause of geographical science and to this Society. The Royal Geographical Society owed everything to Sir Roderick Murchison, and he was quite sure that at the fitting time and place we should duly express our acknowledgments. He proposed to write the following letter to Sir Roderick's nephew:—

"I have been requested by the Council of the Royal Geographical Society, which held its sitting this afternoon in Whitehall Place, to express the deep feelings of sorrow with which they have learnt of the serious illness of Sir Roderick Murchison, and their earnest hopes for his recovery; and I am further empowered to say, on behalf of the great body of the Fellows of the Society, as represented at their regular Evening Meeting in Jermyn Street, that they cordially concur in these feelings of deep solicitude for their venerated President.

"*London, Nov. 29th*, 1870."

Sir HENRY RAWLINSON concluded with the following words:—"I may consider from your plaudits that the proposition is received with acclamation, and I shall accordingly send my letter to Sir Roderick's nephew to-morrow morning. The bulletin I have received this evening is in these words: 'Sir Roderick Murchison has had a good day, and is stronger this evening.'"

The following Paper was read:—

On the Geography of the Bed of the Atlantic and Indian Oceans, and the Mediterranean Sea. By Captain Sherard Osborn, R.N.

After some preliminary remarks, Captain Osborn said he proposed to confine himself to one section of the harvest of knowledge regarding the sea-bed we are now garnering, viz.:—That which tells of the depth of the ocean and the character and form of the earth's crust on which it rests: a knowledge still far from perfect, but which has made such important progress, that within the last few years we have been enabled to lay nearly 17,000 miles of submarine telegraph cable (worth more than six millions sterling) across those silent depths with perfect safety; and, aided by electricity, are bringing the uttermost parts of the earth into momentary communication with each other.

The diagrams which were exhibited represented our knowledge of the form of the ocean-bed throughout the following seas:—

Three represented cross-sections of the North Atlantic. One between the Shetlands and Labrador, through a great curve *viâ* the Faroe Isles, Iceland, and Greenland; a second between Ireland and Newfoundland; and a third between France and the United States, touching the Great Bank of Newfoundland.

Another was a section of the two Atlantic Oceans in a longitudinal direction, from the parallel of England to that of the Cape of Good Hope.

A third was a section of the Mediterranean Sea from the meridian of Gibraltar to that of Alexandria.

In the Eastern Hemisphere, there were sections of the bed of the Indian Ocean from Penang to Ceylon, and from Bombay to Aden, and up the Red Sea to Suez.

In the diagram, Captain Osborn delineated the different character of the bottom of the ocean by varied tints of colouring. Nothing, so far as those descriptions of bottom were concerned, was left to supposition,—the diagrams being based on assured soundings; and wherever sand, shell, coral, ooze, &c., were drawn, the fact had been verified by the bottom having been drawn to the surface in the sounding-tube, in quantities varying from a quillful to that of a small coffeecupful. If at any time hereafter additional soundings should be procured, or specimens of the bottom obtained at variance with the data upon which the diagrams were founded, it would be easy to insert the necessary corrections.

The northernmost section of the Atlantic was delineated upon the soundings obtained by Captain Sir Leopold M'Clintock, during his Hydrographic Survey for a North-about Cable Route in 1860.

The section between Ireland and Newfoundland was almost entirely the result of the soundings obtained by Captain Dayman of our Royal Navy, and some of those by Lieutenant Lee, U.S. Navy.

The section between France and New York was the result of a portion of some of Captain Dayman's soundings, considerably added thereto by Navigating-Lieutenant V. F. Johnson, R.N., in 1869, when we had to complete that section to enable the Telegraph Construction Company to submerge a cable from Brest to New York, *viâ* the Island of St. Pierre.

The longitudinal section of the Atlantic Ocean was entirely based on the admirable series of soundings obtained by Captain Shortland, of H.M.S. *Hydra*, when on her voyage home from the Cape of Good Hope in 1868. The line of that section was best understood by referring to the Admiralty chart, on which the track of the *Hydra* is delineated. Thanks to the valuable deep-sea soundings, and the specimens of the bottom which were nearly in all cases obtained by Captain Shortland, we have a fair representation of the form of the bed of the two Atlantic Oceans in a north and south direction.

The three cross sections between Europe and America showed that the maximum depth in no case amounts to 3000 fathoms, or 18,000 feet, and the greatest depth is in about the 42° w. long., where 2760 fathoms were obtained by Lieutenant Johnson, and about 300 miles north of it it was still 2400 fathoms deep; and Sir Leopold M'Clintock, 450 miles further north, and a little to the westward, still found a depth of 2000 fathoms in the valley of Davis' Straits and Baffin's Bay.

This might be called the Western valley of the Atlantic. It was possible that a little further south than these cross sections of the Atlantic, and in the direction of the Gulf Stream, deeper water might yet be found between the Bermudas and the American shore; but, as in the whole range of soundings obtained by Captain Shortland throughout both Atlantics between 50° N. lat. and 35° s. lat. the maximum depth was only 2900 fathoms, Captain Osborn did not think that, even in that western valley of the Atlantic, depths exceeding 3000 fathoms, or 18,000 feet, are likely to exist.

The theory of the force and volume of the Gulf Stream, which Maury ingeniously enunciated as likely to gouge out of the earth's crust an extraordinarily deep trough, has not been verified by soundings round the edge of the Newfoundland Bank; and had the Gulf Stream the force which he and others supposed down to any great depth, we should not have succeeded in 1869 in laying a cable across it without a great loss of slack cable by the current acting upon it.

It is worthy of remark, that the verification of the form of the bottom and the depths obtained by hydrographers is mainly due to submarine telegraphy, for the cable as it is submerged runs over a dynamometer calculated to indicate the strain of the cable running out at a certain speed at the depths shown in the chart. If, therefore, the cable-laying ship on the surface of the sea were to traverse some extraordinary depth which the lead had missed, or the cable be subjected to some unknown force occasioned by a rapid current, the dynamometer would immediately indicate it; but, in the three cables which have been successfully submerged across the Atlantic, the strain on the dynamometer has, in all cases, agreed admirably with that due to the depth shown on the charts.

The contour of the North Atlantic Basin may, the author said, be considered as accurately delineated by these sections, and represents two great valleys, separated by an intervening range, which he traced from lat. 40° N. as far as Iceland, in 64 N°., or for a distance of about 1440 miles.

The eastern valley extends in width from 10° to 30° w. long., and the western valley from 30° to about 50° w. long.

Each of these valleys is, therefore, about 20°, or 800 miles * in width. The depth of the eastern valley has a mean of about 12,000 to 13,000 feet below the level of the sea, or rather less in depth than Monte Rosa,† in Switzerland, the highest point in Europe, is in height above it; and as we are able—by consulting the four diagrams—to trace this valley from about the latitude of the Faroes, where it narrows very much and terminates, down as far as the equator, this vast submarine plain may be said to be nearly 62°, or 3700 miles, in length. It may at first sight appear that a valley or plain of such vast extent is unlike anything we know of in the world above the waters; but geographers would remember that the great plains of North America extend from Texas east of the Rocky Mountains, down to the shores of the Arctic Circle, and that the aggregate length of the pampas and llanos of South America in no way falls short of this submarine Atlantic valley.

The western valley of the Atlantic has a maximum depth of 16,800 feet, or four times more below the level of the sea than the highest point of the Apalachian or Atlantic mountain system, in America, rises above it.

This valley we are able, thanks to hydrographic soundings, to trace from the latitude of the Azores as far as Greenland, where it

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* The degrees of longitude in this latitude are about 40 miles each.
† Monte Rosa, 15,174 feet above sea-level.

bifurcates, the deeper portion of it pointing still northward up Baffin's Bay; and down its double valley pours that Arctic current (laden with ice-field and iceberg) which plays so important a part in the circulation of the waters of the Atlantic.

The submarine ridge, which divides these two valleys in about 30° w. long., appears to be of singular uniformity of height, or rather of depth, from the surface, having only 1600 fathoms, or 9600 feet, water on its crest, between the Azores and the latitude of the Hebrides, where it rises gradually, and culminates above water in Iceland with the volcano of Hecla and its geysers.

How far south of the Azores this ridge extends, it is impossible yet to say; but, looking to its undoubted volcanic character in Iceland and the Azores, it seems probable that we shall eventually trace its connexion in a south-west direction with that vast volcanic area embraced by the dormant and active volcanoes of the West Indies, the Caraccas, and Guatemala, and of which the Caribbean Sea seems to be the crater.

The eastern Atlantic valley, which was represented longitudinally in one of the diagrams, extends as far south as the equator, having upon its western side the Azores ridge before referred to, and on its eastern side the gradual slope upwards of the foundations of the European and African continents, with the lofty peaks of Madeira, Teneriffe, and the Cape de Verde projected from them.

At the equator a rocky ridge occurs, probably of volcanic character, on which rest the solitary peaks of St. Paul's Rock, Fernando de Noronha, and Ascension. And this ridge serves, as it were, to mark the separation of the North Atlantic Basin from that of the South. Its length may be roughly estimated at about 3600 miles in a north and south direction, with a mean depth of water in it of 1300 fathoms.

From the equator, Captain Shortland's soundings prove that the bottom of the South Atlantic deepens gradually until, in about 20° s. lat., its depth is again 2800 fathoms, or exactly the same as the maximum oceanic depth yet obtained in the Western Valley of the North Atlantic. Whether this remarkable coincidence points to the fact that the Oceanic depths in the southern hemisphere will be found not to exceed those of the north, it would be premature yet to say, but the day is not far distant when a line of soundings will be obtained from the American continent across the South Atlantic and Indian Oceans to Australia, placing that question beyond all doubt.

The Section of the bed of the Mediterranean Sea between Gibraltar and Alexandria is based on soundings obtained by Captain

Spratt, R.N., Captain Nares, R.N., and a few furnished by the French Hydrographic Department.

It will be seen that this sea is divided into two basins or valleys by a lofty block of land, probably of volcanic origin, lying between 10° and 15° E. long., having only a maximum depth of from 200 to 300 fathoms of water on top of it; and out of its crest projects Sicily, with the active volcano Mount Ætna, and numerous islands and shoals, such as Malta, Pantellaria, Skerki Rocks, &c.

The Western basin from this Central Submarine Range, until the Straits of Gibraltar are approached, is singularly level, averaging from 1400 to 1500 fathoms, or 8700 feet below the level of the sea, and covered with soft mud or ooze.

The Eastern basin, between Malta and Alexandria, is less uniform, the bottom being undulating, and ranging from 2150 fathoms to as little as 1100 fathoms; but the bottom, throughout the deep part of this valley, consists of mud, similar to that found in the Western valley. These two Mediterranean basins are, as the geographer must be aware, of very irregular shape—the maximum length of the eastern one extending from Malta to the shores of Syria, south of Crete and Cyprus, and the western basin having a long deep-water valley, extending north and south from Algiers to Toulon. In the Western basin a scientific expedition, under the auspices of the Royal Society, has been at work in Her Majesty's Ship *Porcupine* during the past summer, and there is reason to hope that the results will be as valuable to all interested in the progress of the physical geography of the sea as their previous explorations in the Atlantic are likely to be. It is worthy of remark, that in both these basins the shores are for the most part rocky or coral when within a depth of 200 or 300 fathoms; but that, despite of the near proximity of volcanoes like Ætna, Stromboli, and Vesuvius, no volcanic disturbance has taken place in either of these valleys over a period of ten years sufficient to disturb so sensitive a test as a submarine cable.

It will be observed, in these delineations of the bottom of the Atlantic Ocean and Mediterranean Sea, that there is a great absence of anything like abrupt depths or sharp outlines, that the contour is soft and rounded, and that there is a remarkable absence, for so vast an area, of bare rock. This remark will be found to be applicable to all the sections of the deep sea: the author owned that he was not prepared for it, and that it was only after the experience of ten years that he accepted it. His first idea of the bottom of the sea was, perhaps, the same as that of a good many other geographers, viz., that we should find the crust of the earth under-

neath the element called water very much what we knew it to be under the element called atmosphere.

On a superficial view of the subject it was natural to suppose that if the earth above water was marked by abrupt mountain-ranges, steep table-lands, with deep valleys, clefts, cataracts, *cañons* or *quebradas*, that the crust of the earth even under the ocean would resemble it; but this he felt almost convinced is an erroneous theory, and that the bed of the ocean is not subjected to the wearing forces which occasion all these phenomena on the earth proper. He doubted much whether the currents of the ocean extend to any very great depth. Indeed the experience of all our cable-laying expeditions, which are now pretty numerous, as may be seen by reference to the accompanying charts, go to prove that though there may be—and there is no doubt—a healthy circulation going on in all depths, even the most profound, that there is an absence of those mighty streams which, did they exist, would plough up and constantly change the form of the bottom of the sea, in the same way that water and atmosphere combined act upon that portion of the crust of the earth which is above the great waters.

In fact, if the waters were removed to-morrow from the bed of the Atlantic, it would much resemble those comparatively level regions known to us, such as the Desert of Sahara, the Prairies of North America, or the Pampas of the South; and *they* likewise were once, in all probability, the bottoms of ancient oceans.

The author remarked, in regard to the oceans and seas of the western hemisphere, how little variety there was in the nature of the bottom where the depth ranges from 6000 to 18,000 feet, and how rarely (so far as hydrographic surveys have gone) the rock crops through the submarine surface. When the first line of soundings were obtained between Newfoundland and Ireland, and stony bottom was only recorded in one spot, 33° w., hydrographers and engineers were so struck with the fact, and of the extraordinary advantages it offered as a soft bed on which to lay submarine cables, that it was denominated "The Telegraphic Plateau;" but subsequent explorations prove this characteristic to be by no means confined to one place, but to be general throughout the whole area of the deep ocean. In fact we had here another proof of the sound geological deduction that there is a constant accumulation, on the deep-sea bottom, of the *débris* of successive generations of organic life, pervading all its depths and all its varied climates. Where on these sections the hydrographer marks ooze, soft mud, and fine shells, the geologist and naturalist recognise the great processes of nature where the remains of organic

life, with which the ocean teems, are forming strata of limestone and chalk, the basis which, acted upon by heat and pressure from volcanic causes, form the marble and calcareous rocks of the earth above water.

Before passing to the consideration of the waters in the Eastern Hemisphere, Captain Osborn pointed to two spots on the ocean-bed of the Atlantic, which were already invested with historical interest. The one where, from a depth of 1657 fathoms of water, the telegraph cable, which was lost in 1865, was recovered on the 2nd September, 1866, spliced, and eventually connected with Newfoundland; and the other in 90° long., and 2000 fathoms water, where the French cable had suddenly to be cut, and allowed to descend to the bottom, and yet was recovered within forty-eight hours: two feats, of which the sailor and engineer may justly be proud, and which English telegraph-cable manufacturers may claim as unparalleled achievements.

He then passed to a consideration of the sections of the Indian Ocean north of the equator. Thanks to the admirable surveys of Captain Bullock, in H.M.S. *Serpent*; Captain Stortland, in H.M.S. *Hydra*; Captain Pullen, in H.M.S. *Cyclops*; and the verification of the two last by Captain Halpin, of the Mercantile Marine, whilst employed by the Telegraph Construction and Maintenance Company this year, in laying a cable 3600 miles long, from Bombay to Aden and Suez, we had now very accurate sections of the ocean from the Malay Peninsula to Hindostan, from Hindostan to the entrance of the Red Sea, and thence to Suez. One Section carries us from Bombay, down a gentle slope of about 240 miles in length, with a depth increasing from 28 to 1900 fathoms water, where the extreme level of the bottom of that ocean is reached, and it then extends with singular uniformity with a soft muddy bottom, never exceeding 2200 fathoms in depth, for 14 degrees of longitude, or 840 miles, until we approach what may be considered as the upward slope of the African continent, forming a basin singularly resembling the great valleys of the Atlantic bed, both in contour and extent.

The Section of the Red Sea between Aden and Suez was very different in character. It represented a series of submarine hills of rounded outline, but it will be observed that that outline (which of course is the centre of the sea) is everywhere covered with silt, mud, and sand,—the latter characteristic naturally arising from the vast quantity of sand thrown into the Red Sea by the winds blowing over the deserts of Africa and Arabia, which eventually settle to the bottom; and Professor Huxley told the author that in examining with the microscope the fine mud which Captain Shortland's

soundings brought up over the area between Africa and India, this fine sand, in smaller or greater quantities, was the only distinctive feature between the ooze of the bottom of the Indian Ocean and that of the Atlantic.

Apart from the depth of water, contour of the ocean-bed, and nature of the bottom, Captain Shortland procured a beautiful series of the temperatures of the sea at various depths between Bombay and Aden, showing that on the Bombay bank the surface water ranged from 72° to 78° Fahr., whilst the bottom water was from 73° to 77°. Coming off this bank the surface water, 75°, was found gradually diminishing to 50° at 500 fathoms, 42° at 1000 fathoms, and then rapidly descending, until, after reaching a depth of 1700 fathoms, the temperature was nearly constant at 33½° Fahr. This was a most interesting fact, because the Mosambique Gulf-stream, which that officer sounded across, carries with it a volume of warm water, equal in temperature to that of the Atlantic Gulf-stream; and as the warm water of the Mosambiqne stream did not appear to extend downwards below 100 fathoms, we might safely infer that, when the Atlantic Gulf-stream is similarly sounded and tested, we shall not find its depths or volume vertically so great as had sometimes been suggested.

So level was the bottom of the Indian Ocean, and so accurate were the depths on our charts, that Captain Halpin assured the author that when he was laying the Indian cable, he could, had he not been stringently forbidden to go faster than five knots an hour, have safely laid it running the *Great Eastern* at a much greater speed.

Turning from this portion of the Indian Ocean to that on the eastern side of the Indian Peninsula, another basin, or submarine valley, was found, singularly resembling the one above alluded to; for 11 degrees, or 660 miles of longitude, the depths again range from 1000 at the sides, to 2280 fathoms in the centre, with a similar bottom of clay and ooze, and a gradual ascent on the east to the shoulder of a ridge, which no doubt extends north and south in the Bay of Bengal, from the crest of which project upwards the Nicobar and Andaman Isles. There is then a slight fall, until the entrance of the Straits of Malacca is approached, when we come on a plateau with only 30 or 40 fathoms of water, which extends eastward through the Straits of Malacca, as far as Borneo on one side, and Cochin China on the other.

To this eastern Indian Valley the same remarks are applicable as to the Western Indian one, and, indeed, to the general features of the Atlantic bed. Across it a submarine cable is now being laid, which will bring China, the Eastern Archipelago, and the

Dutch possessions into as rapid and certain communication with us as we have to-day with India, Egypt, and the United States.

The author did not propose to dwell on other interesting physical facts revealed by the labours of the gallant officers and men of science who worked out these important surveys, beyond stating that, in profound depths of the Atlantic and Indian oceans, a temperature ranging from 33° to 35° Fahr. is everywhere found, showing that at the bottom of the ocean a uniform climate exists, so that there is little doubt that throughout all that sub-oceanic region organic life to some extent is to be met with; and he, having seen all forms of animal life abundant and living in the darkness and rigorous climate of our Northern Pole, could not but cordially agree with the suggestion of Messrs. Carpenter, Jeffreys, and Thomson, in their treatise on 'Scientific Exploration of the Deep Sea' that there is light as well as life in the most profound abyss, and that possibly the phosphorescence which the sailor and the naturalist have everywhere remarked in connection with the inhabitants of the ocean, serves—in regard to their obtaining a supply of food, the great object of animal life—to perform the function at the bottom of the sea which light renders us on the earth above the water.

Taking a general view of the diagrams, he had endeavoured, aided by his friend Mr. Bedwell, R.N., to submit to the Society accurate sections of those portions of the ocean in the Eastern and Western hemispheres which have been sounded; and he thought we might safely infer that the general features of the rest of the Indian and Atlantic oceans would be found, when explored, not very dissimilar.

The Pacific Ocean will, before long, be sounded across from California to Japan, and from the Sandwich Isles to Australia. A few soundings have already been obtained in the North Pacific, and that great ocean is nowhere found to be 3000 fathoms in depth, showing, as had already been said, that we may now feel pretty sure of having the maximum depth of all deep oceans. Whether the Polar areas, either of the north or south, will ever be sounded and surveyed in our time, is a question; but, seeing how steadily and constantly our knowledge of the physical geography of the sea is progressing, it would be wrong indeed not to believe that before many years the icy barrier of the Arctic zones would have to yield up its mysteries to the enterprise and energy of our seamen and men of science.

Captain Osborn, in conclusion, bore testimony to the valuable services rendered by the Hydrographic Department of the Admi-

ralty to the progress made within the last few years in deep-sea soundings.

There is no doubt that the surveyors of the United States' Navy took the lead, under the inspiration of Captain Maury, in this research; and to Lieutenant Brooke's ingenious invention, whereby the weight could be detached after the line struck the bottom in great depths, is mainly due the success with which that branch of hydrography has been recently pursued, for it was not until the surveyor could recover all the line payed out, and bring to the surface a specimen of the bottom reached, that deep-sea soundings could be considered reliable, and all previous attempts were simply tentative.

The data upon which the diagrams had been prepared, Capt. Osborn said, were to be found on the respective sheets of the Admiralty Charts, and it was only just to his distinguished friend, Admiral George H. Richards, the Hydrographer of the Admiralty, to point out how deeply indebted men of science, sailors, and the public generally, were to him for the marked progress made since he has held that office, to the extension of deep-sea soundings, and the collection of other valuable data, without which it would have been impossible to place these charts of the bottom of the ocean before the meeting, or for Submarine Telegraphy to have succeeded in bringing the uttermost parts of the earth together, as it has done in our time.

The paper will be printed entire, with diagrams, in the 'Journal,' vol. xli.

Professor Huxley said the facts which had been laid before the Society were extremely interesting to several classes of men of science. They were so, first, to the physical geographer, and next to the naturalist pure and simple. No doubt it was of immense importance to get at the real facts of the configuration of the sea-bottom, about which physical geographers had at various times held such very different opinions. The statement of facts which Capt. Osborn had so clearly and vividly laid before them with regard to the nature of the sea-bottom confirmed entirely the impressions which had been orginally derived from the survey of the Atlantic bed, and showed that it was anything but that scoured, grooved and gulfy kind of surface which it had commonly been supposed to be. He could not, however, agree with Captain Osborn with regard to the great difference which he supposed to exist between the bottom of the sea and the surface of the land. No doubt the difference was great if the surface was looked at on a small scale, and if they only took into consideration depths of not more than a few hundred feet, because the great agents of denudation of dry land—falling water, rain, and rivers—had no effect upon the sea-bottom, and therefore on that bottom the scooping and scouring effects of those agents were not produced. He thought, however, the difference ceased with the minor details of the surface. If some of the sections of the surface of Britain, the work of the Geological Survey, had been hung up side by side with Captain Osborn's diagrams, it would at once have

been manifest that, viewed upon a great scale, there was exceedingly little difference between the general configuration of the land and that of the sea-bottom. The notion of what a general section of Great Britain from east to west would be, might easily be obtained by considering such a section extending through Snowdon. Taking the horizontal length of the section at about 200 miles, the height of that mountain would be less than one two-hundredth of the length of the surface above the sea-level, and, if a diagram representing the section were six inches high, it would have to be one hundred feet long to represent on a true scale the surface of England; and then the inequalities of the surface would not appear more conspicuous than those of the Atlantic bed on a similar scale. The steepest declivity would probably not be more than 30°. In the same way, if a section on a true scale were taken of one of the most rugged regions in the world, such as the Himalaya, the sudden variations would not appear greater than on the diagrams of the sea-bottom. These remarks referred entirely to the great features of the surface, and did not take into account those diversities which were caused by the gnawing action of rains and rivers, such as the cañons of the River Colorado. In the sea any such diversities would be smoothed off by the waves, and subsequently filled up by the material accumulating on the bottom. Another consideration, which would show that the difference between the surface of the land and the bottom of the sea could not be very great, was that the bed of the sea was once a land-surface, subjected to the same agency as the present land. With regard to the Natural History aspect of the paper, it was a remarkable circumstance that the specimens which he had examined of the deposit found by Captain Shortland at the mouth of the Red Sea were composed of very fine sand and great quantities of the organic substance he had named *Bathybius;* besides these there was hardly anything else, except broken remains of *Globigerinæ*. The *Bathybius* formed a living scum or film on the sea-bed, extending over thousands upon thousands of square miles: evidence of its existence had been found throughout the whole north and south Atlantic and wherever the Indian Ocean had been surveyed, so that it probably forms one continuous scum of living matter girding the whole surface of the earth. This opinion had been confirmed in all its essential details by Professor Haeckel, who has published an admirable account of specimens obtained by him. These investigations had caused on all sides a most extraordinary activity among naturalists and palæontologists; and Dr. Gümbel, of Vienna, had informed him that he had found some of the most characteristic organisms of the deep sea—viz. coccoliths and coccospheres—in all the superficial and shallow-water deposits, and even in the littoral deposits of various seas; so that these wonderful things, the nature of which was not at present known, must not be regarded as confined to the great depths of the ocean, but as existing in all parts of the ocean, deep and shallow. A still more remarkable fact was that Dr. Gümbel had discovered the remains of these same coccoliths throughout the whole series of sedimentary strata—thus confirming the view previously entertained by geologists of the conditions under which these stratified rocks had been formed. This result was one of the most important which had been obtained by Palæontologists for many a day. Another problem connected with the subject of the paper was the question of how these things lived at those great depths. He did not agree with the hypothesis that their own phosphorescence served them in the place of light. Such a doctrine was simply that of perpetual motion in a new shape; because the light supplied to plants was a particular form of motion, converted by them to other shapes, and it was evident that a living thing could not very well throw out the motion which was to be converted into other forms for its own purposes over again. But it had been forgotten, in the discussions upon this subject, that there was a large group of organisms belonging to the

group of the *Fungi* which did not need light at all. He saw nothing to prevent organisms of low character from developing themselves in any quantity at the bottom of the sea. He therefore thought the biological difficulty did not exist. The British Government was often loudly assailed for its apparent insensibility to the claims of science, and quite recently most undeserved attacks had been made upon the Government for supposed neglect of scientific interest in a matter in which no neglect had been shown; but it was evident that, with regard to the investigations of the deep-sea bottom, the officials of the Government, and especially the Hydrographer to the Admiralty, had proved that they were quite sensible to the claims of science.

Mr. Gwyn Jeffreys said that marine conditions, of course, differed from those of land; the former tending to an increase, the latter to a decrease. When it was stated that the bed of the North Atlantic was very level and even, it ought to be remembered that the data were obtained from soundings at intervals of fully 50 miles apart, and therefore the charts founded on those data could not be regarded as giving an exact representation of the bottom. His own experience in the *Porcupine* convinced him that there were considerable inequalities in the bed of the North Atlantic. In the last expedition which he conducted, the depth ascertained by sounding and dredging varied from 1095 fathoms to 740 fathoms within a quarter of a mile. This, of course, showed a great inequality; and, no doubt, further explorations would lead to similar conclusions. The nature of the sea-bottom was not exactly what it was generally supposed to be. The sounding-machine only brought up a very small sample of the bottom; and he believed that gravel was deposited over a very large area of the North Atlantic bed. Gravel and hard materials were to be found throughout the whole extent of the line of the Arctic current, which sweeps from the North Pole to temperate, and, perhaps, very low latitudes. It was important for those engaged in oceanic telegraphy to remember that large jagged flints had been brought to the surface from the Atlantic bed; and, if these were in any numbers, the disturbance connected with the Arctic current would make them very dangerous to cables. Organic life in the ocean was of a twofold kind, consisting not only of free-swimming animals near the surface, but of highly-organized animals of considerable size at the greatest depths hitherto explored. Last year a kind of cuttle-fish had been brought up from between 700 and 800 fathoms; it was of a kind that only inhabits the bottom, and furnished with eyes as perfect as those of most fishes, and, in fact, superior to the eyes of some. Certain mollusca found at depths of 1500 fathoms had conspicuous eyes; and some crustacea had not only the usual number of eyes, but even two on each side of the head, as in the case of the genus *Ampelisca*. There could be no question that those eyes were given for the purpose of finding food and avoiding danger. He doubted the existence of phosphorescent light at great depths, and knew from experience that animals furnished with eyes had been found in places where there was no phosphorescent light. It was true that star-fishes, and other animals which gave out a phosphorescent light, had been brought up from a considerable depth, but one instance was not sufficient to establish such a theory. Marine life was also important in connection with oceanic telegraphy. When the cable between Spain and Africa was taken up some years ago it was found to be perforated by a mollusk (*Xylophaga*) very much like the Teredo. It was found at all depths, and no part of the sea was free from its ravages. It would lodge in a telegraph-cable as well as in a piece of wood. It was, therefore, necessary that the wire should be covered with some metallic substance which would not rust.

Professor Huxley said that, in a second case, the cable was not perforated by the mollusk Mr. Gwyn Jefferys had alluded to, but by a much more destructive animal, the little crustacean *Limoria*.

Captain SHERARD OSBORN, in reply, said that he quite agreed with Professor Huxley in thinking the bed of the ocean very like the surface of the earth above water, except that the latter was seriously affected by the action of fresh water in the shape of rain and rivers. As a proof of how level the bed of the ocean was, in a broad sense, he mentioned that the cable of 1865, lost in the Atlantic, was not more than two inches in diameter, and the three ships that were sent to pick it up hardly ever passed over the position of that little thread without hooking it, although the grapnels swept the bottom for more than a hundred miles. This showed that the bottom must be very level. To resist the attacks of the perforators he mentioned, the danger was known, and guarded against by the interior of the wires which covered the cores of all submarine cables, as well as the exterior, being coated with a solution of pitch and tar, containing large quantities of silica, or flint powder, which the experience of the Persian Gulf cables proved to answer all practical purposes.

Third Meeting, 13th December, 1870.

SIR H. BARTLE FRERE, K.C.B., VICE-PRESIDENT, in the Chair.

PRESENTATION.—*Major-General J. A. V. Kirkland.*

ELECTIONS.—*Samuel David Dymes Esq.; Colonel T. G. Glover*, R.E.; *R. Manners Gordon, Esq.; Captain L. W. Longstaff; Edward Masterman, Esq.*, Jun.; *Don Pompeio Moneta* (Chief Engineer Argentine Republic); *Charles Pannel, Esq.; Alfred Robinson, Esq.; George Sandford, Esq.; T. Scobell, Esq.; C. A. Winchester, Esq.*

ACCESSIONS TO THE LIBRARY FROM NOVEMBER 29TH TO DECEMBER 13TH, 1870.—'The Pelew Islands, 1803.' By H. Wilson. Donor A. G. Findlay, Esq. 'The Recovery of Jerusalem.' By Capt. Warren and Capt. Wilson, R.E. Introduction by Dr. Stanley. Edited by W. Morrison, 1871. Donors, Executive Committee of the Palestine Exploration Fund. 'New Tracks in North America.' By W. A. Bell. 2nd Edition, 1870. Donor the author. 'Voyage dans la Peninsule Arabique du Sinai, &c.' Par Lottin de Laval. Paris, 1855-1859. Purchased. 'Tour in Normandy.' By H. Gally Knight, 1841. Purchased. 'Geographiæ et Hydrographiæ reformatæ.' By J. B. Riccioli. Venetiis, 1672. Purchased. 'Voyage to the North-West Coast of America, 1789.' By J. Meares. Purchased. 'Moscow to Constantinople in 1817, 1818.' By Macmichael and Legh. Purchased. 'Visits to Loochoo, Japan, and China, 1856.' By A. L. Halloran. Purchased.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING, NOVEMBER 29TH, 1870.—Maps of the Seat of War, on a large scale. By E. Stanford, F.R.G.S. Sheets Nos. 9, 10, and 11. Presented by the author. Johnston's War Register. Sheet 9, bringing the War news up to December 10th. 1870. Presented by the Author.

The CHAIRMAN announced that a letter had been received, published in a Florence newspaper, from the Chevalier Cristoforo Negri, the originator and President of the Royal Geographical Society of Italy, expressing the extreme regret of that Society on hearing of Sir Roderick's illness. This Society had only been in existence about four or five years, and had at the present time 1215 members.

The following Paper was then read :—

A Year in Patagonia. By Lieutenant G. C. MUSTERS, R.N.

[ABSTRACT.]

THE author having planned a journey through Patagonia, left Punta Arena, in the Straits of Magellan, on the 19th April, 1869. His party consisted of Lieutenant Gallegos, four soldiers, himself, and guide. Having followed the coast-line for a few leagues, they emerged from the forest, and passing the Rio Chaunco, entered on the Pampas, where the first thing they experienced was a bitter cold wind from the west. They encamped the first night on the banks of a large lagoon abounding in wild fowl, and slept comfortably in the tent, although the frost was sharp outside. Next morning they crossed the "Cabecera del Mar," a wide inlet running inland some leagues from Peckett Harbour. Next day they entered a valley of considerable extent, about twenty miles long, bordered on the western side by the cliff-like slope of the high pampa, called the "Barranca of San Gregorio," and on the east by a range of low hills. About mid-day they emerged from the northern end of the valley, and came into a different country, open and undulating. After a few more hours' riding in the direction of a peaked hill, lying about N.N.E., they came to the verge of a deep cañon running nearly east and west. A descent of about 200 feet brought them to the banks of a small but deep stream, without trees, but affording plenty of pasture. Here they encamped for the night. Lieutenant Musters was assured by "Aria," the guide, that this cañon extends from the Cordillera to the sea, but runs in a tortuous course. Resuming their route, they headed in the direction of a range of peaked hills. Their appearance was decidedly volcanic; the rocks being tumbled one upon another in wild confusion, assuming in many cases strange fantastic shapes.

Next day they arrived at the valley of the Rio Gallegos, the descent to which is in the form of two successive benches or plains, a mile and a half in width, with a descent of fifty feet, the river flowing in a broad bed below the second bench. This river attains its greatest height in the months of August and September, when it is impassable except by swimming.

Two days afterwards they crossed the river; the Indian guide

had absented himself for some time, as it turned out, for the purpose of lighting a signal-fire, and suddenly numerous Indians galloped up. Lieutenant Gallegos made them a present of charqui and biscuit; the Caciques forming their men into a semicircle to receive the present. They were all fine-looking men; more than one of them standing over six feet, and one being at least six feet four inches. The broad chests and the muscular development of their arms struck Lieutenant Musters particularly.

On the 25th, after riding several hours over a particularly barren and desolate pampa, the Rio Santa Cruz suddenly came into view. The sterile nature of this pampa, bordering the river, curiously resembled that of the Travésia, on the south side of the Rio Negro. They reached the valley by a descent of perhaps 400 feet, and about 7.30 P.M. arrived opposite the island of Pabon (marked in Fitzroy's charts as "Middle Island"), where the settlement owned by Don Luiz Piedra Buena is situated. After a little trouble in crossing the ford, occasioned by the tide rising rapidly, and almost rendering it necessary to swim their horses, they were most kindly received by Mr. William Clarke, the manager of the establishment.

Lieut. Musters determined now to accept the hospitality offered him in Santa Cruz, and start, with the Indians, in August, on a land journey through Patagonia to the mouth of the Rio Negro, and employ the interim in learning their language, manner of hunting, &c., &c.

During the month of July the weather was intensely cold, the southern channel of the river being frozen over and the northern branch covered with floating ice.

In the beginning of August the weather became milder; and on the 12th, after two or three slight delays, Lieut. Musters with the Indians marched 10 leagues up the valley of the Rio Chico. Most of them marched again the next day, with Casimiro, to join another party under the leadership of the petty chief Camillo. The united party, as finally formed, consisted of seventeen able-bodied men, eight or nine belonging to the southern Tehuelches, and the remainder to the northern tribe. The party was under the immediate command of Orkeke and Casimiro, who was really the head chief, having been invested with the command by the Buenos Ayrean Government. There were, besides the men, a good many women and children. All these people were housed in five toldos, with their fronts looking to the east on account of the prevalent westerly winds. The toldo has been completely described by Fitzroy, but a sketch of one may not be unacceptable to those unacquainted with it.

It is simply and speedily constructed. A row of forked posts, about 3 feet high, are driven into the ground, and a ridge-pole laid across; in front of these, at a distance of about 6 feet, a second row, 5 feet high, with a ridge-pole; and at the same distance from these a third row, 6 feet high, are fixed. A covering, made of from forty to fifty full-grown guanaco-skins, smeared with a mixture of grease and red ochre, is drawn over from the rear and secured by thongs to the front poles. Hide curtains, fastened between the inner poles, partition off the sleeping-places, and the baggage piled round the sides excludes the cold blast. In bad weather an additional covering is secured to the front and brought down over an extra row of short poles, making all snug.

The duty of pitching and striking the toldo, as well as of loading the string and poles on the horses, devolves on the women, who show great strength and dexterity in the work.

The order of march was as follows:—Shortly after daylight the cacique came out of his toldo and delivered an oration, explaining the direction of the march and the programme for the day. After he had finished his oration, the boys and young men fetched up and lassoed the horses. On their arrival, the women struck the toldos, loaded the horses, and, when they were ready, moved off in single file; the men drove the spare horses for a short time, then handed them over to the care of the women and diverged to a neighbouring bush, where a fire was kindled, and the hunt was arranged in the following manner. Two men started off, and rode round a certain area of country, lighting fires to mark their course. They were, shortly after, followed by two others, and so on, till only a few were left with the cacique; these spread themselves out in a crescent, gradually closed in, and narrowed the circle on a point where those first started had by this time arrived. The crescent rested on a base-line formed by the slowly-proceeding caravan of women, children, and baggage-horses.

The ostriches and guanacos ran from the advancing party but were checked by the pointsmen, and, when the circle was well closed, were balled on all sides; two men frequently chasing the same animal from different sides. The Indian law of division of game was rather good. The man who balled the ostrich first left it for the other to carry; it was afterwards divided: the feathers and best part belonged to the captor, the remainder to the assistant. Of guanaco, the first took the best part in the same manner; the lungs, heart, and marrow were sometimes eaten raw.

After the hunting was concluded, all dispersed in groups, made fires, cut up the game, cooked, and ate; then, after a smoke, they

mounted and went to the toldos, which by this time the women had pitched and arranged.

The party made four marches in succession, averaging 8 or 10 miles each; then rested for several days in a place where the valley of the river was wider and the pasture more abundant. Here the attainment of the age of puberty of one of the girls was celebrated according to custom. A tent was made of coloured ponchos, in which she was placed; then mares were slaughtered, and a general feast took place. The fête wound up with a dance round the fire in the evening, performed by the men only; the dancers' heads ornamented with ostrich-plumes, and their bodies with streaks of white paint, and with a strap covered with bells reaching from the shoulder to the hip.

They resumed their march up the river, and travelled, with occasional rests, in a W.N.W. direction, till September 1st, the weather still continuing very cold. On that day they first sighted the snow-clad Cordillera, about 60 miles distant; soon after, they crossed the Chico, making their way with difficulty through large masses of floating ice. One or two of the women were upset, but, happily, managed to get safe to the bank.

After leaving the valley of the Rio Chico, they proceeded northwards by forced marches, following a spur of the Cordillera for some days, then crossed it, and encamped in a valley at the foot of the mountains. Here they stopped some days to rest the horses, and afterwards marched for two days through a barren, rocky district, intersected by deep ravines, with precipitous cliffs, the faces of some of which showed beds of red ochre, visible at a great distance. This desert terminated in a hill, called by the Indians "God's Hill," from which their traditions state the animals to have been dispersed. The view from this was more encouraging: rolling plains extended to the northward, and the Cordillera rose like a wall on the western side. They marched slowly, with frequent halts, through this country, and streams occurred every few leagues. Between the 1st and 5th of October they crossed two streams of considerable size, and arrived, on the 16th, at the wooded banks of a river called by the Indians "Sengel."

On the 3rd of November, they joined the main body of the Indians occupying about forty toldos, situated in a beautifully watered valley, called "Henno." A day or two afterwards another party, composed of Pampas and Tehuelches, arrived from the direction of the Chupat Welsh colony, and were received in due form.

The ceremony of welcome was as follows:—Both parties, mounted on their best horses, form into line with their arms in their hands.

The chiefs ride up and down the line, haranguing, while the men halloo in a peculiar manner, uttering "Wap wap" at intervals. A messenger or hostage, usually a son or some near relation of the chief, then goes over from each party; the new comers then advance, form into columns of threes, and ride round the other party, firing guns and revolvers, shouting, and brandishing their arms. After going two or three times round, at full speed, they charge out as if attacking an enemy; then form into line, while the other party go through the same manœuvres. After this the chiefs advance, and shake hands, each in turn, expressing their welcome, with the utmost formality.

They remained in Henno about a fortnight, resting their horses, and then marched to a place a few leagues west, called "Chiri," from a bush which grows in large quantities on the banks of the stream; the leaves resemble those of the blackthorn, and it bears a currant-like fruit. After making several hunts in the surrounding country, they divided into different parties to chase the young guanaco. Lieut. Musters' division went to the west, and remained until December in the plains, close to the foot of the Cordillera, during which time they killed large quantities of guanaco.

On the 11th December the author accompanied Orkeke, who, with two toldos, marched straight for the mountains. Their route led through a country devoid of large streams; they passed through several of the basin-like valleys, which Darwin describes as occurring on the western side of the Cordillera. The surface consisted of a thick yellowish clay, with, occasionally, beds of stone of considerable size. One valley was at least 20 miles in diameter, lying about 50 feet below the Eastern Pampa; they exactly resemble the dry beds of huge ponds or lakes.

They at last arrived at a beautifully-wooded park-like country, where they remained some days hunting, with varying success. On one occasion, the author killed one of a species of red-deer; also a large fox, resembling the Falkland Island breed.

On the 25th December they made an excursion into the Cordillera, the object being to hunt wild cattle. They traversed a gradually rising grassy plain between the mountains, at last reaching the watershed from which streams, fed by springs and mountain rivulets, flowed eastward and westward; from this point the defile closed in. They travelled about 50 miles westward, keeping, as well as the cliffs and forests would allow them, in the line of the river, and were within about three hours' march of the Pacific, as well as could be judged. They reached a large open plain, free from trees, at the western apex of which was the confluence of

the river they had followed, and another from the south, the two together forming a large stream.

They marched north on the 27th, and shortly afterwards arrived at "Tekel," the place agreed upon by all the Indians they had met with as a rendezvous, where they remained till the end of January, the women being employed in making mantles of the young guanaco-skins.

Their prolonged stay there enabled Lieutenant Musters to study all the manners and customs of his Indian friends, who now looked on him as one of themselves. It would not be amiss to give a short description of the dress, and some of the habits of these Indians.

The physique of some of the men is strikingly good; their appearance, as to height and muscular development, had been already described. Their dress consists of mantles of guanaco-skins, ornamented in various patterns with paint (a specimen of which Lieut. Musters exhibited), and chiripas, worn round the loins, made of cotton or linen stuffs obtained from the settlements. Their long hair is confined with fillets, plaited in a peculiar pattern, of the threads of unravelled cloth; their boots made of the hide stripped from the leg of a horse, and often secured by a gay-coloured garter. They adorn themselves with white, red, and black paint. Their proper arms are a single bola, or bola-perdida, sword, and lance; to which they have recently added guns and revolvers, obtained in the settlements. The coats of mail made of cow-hide, thickly studded with metal bosses, are becoming disused since the introduction of firearms. Their principal wealth consists in horses and accoutrements, skin mantles, and arms; they are inveterate gamblers, manufacturing their cards out of hide, and staking their possessions on a game at primero or panturga, but are scrupulous in discharging their debts of honour. They are also very fond of horse-racing. Another favourite amusement is a game of ball, which is played by four or five at a time; the ball is thrown up from under the thigh, and struck with the hand at the adversary, each hit counting so many points.

The women are well formed, and, though brown, when young possess very good and ruddy complexions; though they speedily age from work and hardship, for all the heavy household work falls to their share. They wear a skin mantle over a loose calico sacque, which reaches from the shoulder to the ankle, and, when travelling, a girdle ornamented with blue beads, and boots resembling those of the men, except that the hair is left on.

Their coarse black hair is plaited into two long tails, artificially lengthened by interweaving beads, and perhaps borrowed hair, and

ending in silver pendants. They, as well as the men, daub themselves with red ochre and other paints; their chief ornaments are large silver earrings.

They are married very young, generally at about fourteen or fifteen years; but their marriages are always of inclination. If the parents make a match contrary to the daughter's will, she refuses and is never compelled to comply with their wishes. When a youth has courted and secured the affections of a damsel, he sends his friend to her parents, and offers so many horses, mares, &c. If his proposals are accepted, on an appointed day the bridegroom, accompanied by his friends, goes to the bride's toldo, bringing with him the promised presents: they are handed over to the bride's father, who, in his turn, presents an equivalent, which, in case of a separation, the wife is entitled to take with her. During this ceremonial the men shout and the women sing; then the bride is escorted to the bridegroom's toldo, mares are slaughtered, and a general feast held,—the heart, liver, head, back-bone, and tail of the animal being take up to the summit of an adjacent hill, and left as an offering to the "Gualychu" or evil spirit.

Whenever a child falls sick, or receives a hurt which is not mortal, mares are killed and a feast held, to which all are welcome. This is a sort of thank-offering for the hurt or sickness not having proved mortal.

The Tehuelches have a curious custom of bleeding themselves, the object being twofold,—both for health and a propitiatory offering to the evil spirit, who is generally believed to lurk outside at the back of the toldo. They also believe in a good spirit; but their active religion is altogether directed to the bad, and they are much influenced by their doctors or wizards. They are very independent, and pay little regard to the authority of the chiefs, which depends much more on their personal influence and wealth than on hereditary right.

In their family relations they are remarkable for their affection to their wives and children; and, when not excited, they manifest a good-tempered and generous disposition.

On the 20th of January the party broke up from Tekel, and made seventeen marches, crossing numerous streams, feeders of the Chupat. Seventy miles from their starting-point they crossed a considerable stream coming from the north-west, the northern branch of the Chupat River, which the Indians informed Lieut. Musters flowed from a large lake in the Cordillera. The last five or six marches led them through a very elevated and barren country; the high Pampas being strewn with sharp stones, and terminating in

steep cliffs, at the bottom of which were grassy plains and water-courses.

On March the 23rd they arrived at Geylum, a large plain well watered and with good pasture, lying about 12 leagues east of a large lake. They had previously united with two bands of warrior or Manzanas Indians, under the chiefs Quintuhual and Foyel. These Indians are shorter in stature than the Tehuelches, are nearly white, and cut their hair in a line with their ears. They are armed with lances and are better dressed, wearing coloured ponchos made by their women, who are industrious and good-looking, but dislike travelling, resting a long time in the same places. Their proper country is north of the Rio Limay; but these had come south to hunt young guanaco, and catch and tame wild cattle in the Cordillera. With Foyel there were several Valdivians, who spoke good Spanish. They had been catching cattle, and were possessed of a herd numbering over sixty head. They stayed some time in Geylum, waiting for an answer from the cacique Cheoeque, the chief of Las Manzanas. It at length arrived, so all the men and some of the women started, leaving a guard to protect and provide for the remaining women and children. Two days' journey brought them to the Rio Limay, which they crossed with some difficulty, the river being very deep and rapid; on arriving on the northern bank they were met by the Indians of Ynacayal's tribe, who saluted them in the usual manner. They then bivouacked near the toldos, and while sitting by the fire Lieut. Musters received a message, summoning him to a particular toldo, where he found an old Indian who spoke good Spanish. He invited him to sit down, and then told him that an Englishman named "Cox" had formerly descended the river in a boat, but had been wrecked in the rapids about a mile above the ford they had recently crossed; he then took refuge amongst the Indians of Ynacayal's tribe, and ultimately returned to Valdivia, five days' journey distant. After a delay of two days, the united parties proceeded to Las Manzanas, and about 2 P.M. halted in the valley close to, but not in sight of, the toldos of Cheoeque.

Whilst warming and sheltering themselves as best they could from the pouring rain, a messenger dashed up to say that part of Quintuhual's men had had a fight with some of the Manzaneros, and that five were killed, if not more. As these men belonged to the united Indians of the party great excitement prevailed. Guns were loaded and arms got ready for immediate use. Meanwhile Ynacayal arrived with a troop of twenty well-armed men, all having the long lance, as well as other weapons. A party was sent to the

scene of the melée, distant about two miles, to bring off the killed and wounded. Meanwhile a message arrived from Cheoeque with negotiations for a peace. It was determined that they should remain in the valley for the night, keeping a look-out to guard against possible treachery, and proceed at daylight to the toldos. They accordingly spent the night in making bolas-perdidas and shivering round the fires. Next morning they started on their best horses, with guns ready for use and the lancers at their head, for Cheoeque. A few minutes' ride brought them in sight of the toldos, where they observed the Indians under Cheoeque forming in line, lances in hand. It was a very fine sight to see these Indians, neatly dressed in gay-coloured ponchos, manœuvring like disciplined troops.

After half an hour of suspense, hostages were exchanged, and both sides saluted in the usual manner; after which performance, a council was held and lasted till sundown. Peace was made, and several resolutions arrived at. They then dispersed and bivouacked; in the afternoon numerous Manzaneros or Araucanians came round to barter apples and piñones, flour, &c., for knives, bolas, or mantles.

The next day was devoted to festivity, and they returned to the toldos on the 13th of April, having spent twelve days and nights entirely in the open air, in bitterly cold and wet weather. On their return a dispute was with difficulty settled between Foyel's Indians and some of the Tehuelches, which arose out of the latter having helped themselves to sheep and cattle in preference to hunting.

On the 17th they marched for Patagones, turning their backs on the wooded Cordillera of the Andes. Nine marches, occupying seventeen days, brought them to a place called "Margenchau."

From thence Lieut. Musters proceeded with two companions, and after ten days' hard riding, three of which were occupied in crossing the dreaded and sterile Travesia, they came into view of the Rio Negro on the 21st of May, and he arrived at Patagones the following morning.

The Paper will be published entire, with a Map, in the 'Journal,' vol. xli.

Mr. C. R. Markham said that he had been requested by Sir Bartle Frere to remind the meeting, briefly, of the state of our knowledge of Patagonia, previous to the exploring journey of Mr. Musters. This southern extremity of South America was first visited by Magellan in 1520; and Pigafetta, the historian of the voyage, mentions the lofty stature of the natives. The account of the gigantic Patagonians was evidently very extensively read in Europe; for Setebos, the god upon whom, as Pigafetta declares, the young Patagonian captives cried for aid, is mentioned by Shakespeare—

"*Caliban.*—His art is of such power
It would control my dam's god, Setebos."—*Tempest*, Act I.

Mr. Markham touched upon the leading events that occurred when Drake, Sarmiento, Cavendish, Davis, Van Noord, Schouten, Narborough, Byron, and Wallis visited the Patagonian coast; and gave an account of the work published by the Jesuit missionary Falkner, and of the different Patagonian tribes as given by that writer. He then described the explorations undertaken by Don Antonio Viedma from Port San Julian, of the Pilot Villarino up the Rio Negro, of FitzRoy and Darwin up the Santa Cruz, and of Cox to the Nahuelhuapi Lake; and he pointed out how much of our knowledge of Patagonian discovery is due to the indefatigable research of Sir Woodbine Parish. He concluded by saying that the enumeration of these previous efforts only brings out, in stronger relief, the importance of the remarkable journey achieved by Mr. Musters. While previous explorers had penetrated across the country from various points on the coast, he had traversed the whole length of Patagonia from south to north.

Captain SHERARD OSBORN said it was a credit, not only to the profession to which he belonged, but also to the country in whose service he was, that an officer during the time of peace should have accomplished the remarkable feat of striking a bee-line through a country which had hitherto been considered impracticable to European travellers. Repeated attempts had been made from Valdivia to reach the eastern shores of Patagonia, but none had been successful hitherto. Lieutenant Musters, however, had passed through 1400 miles of the country in fourteen months; and, although he mentioned little of his sufferings, he must have had to endure many privations. It was a remarkable fact that a tropical animal such as the puma is to be found so far south as 51°, and tended to confirm the statements of Darwin and others as to the mildness of the temperature in high southern latitudes. The humming-bird was found upon the western shores of the American Continent in high southern and northern latitudes; and when Admiral Collinson was in the Straits of Magellan, a parrot flew off to his ship. It was extraordinary, too, that the potato, or a bulb strongly resembling it, should be found not far from the bamboo. Years ago, when he (Captain Osborn) was in Chili, he took a great interest in the records and many traditions that existed of Spanish castaways, centuries ago, living in small colonies or groups to the east of the Cordilleras, with whom their country people of Chili and Peru had no means of communicating. He fancied, from the description of the Araucanians, that many of those old castaway sailors, and soldiers, and colonists must have merged into the native races, and thus the European type of some of the tribes might be accounted for to which Lieutenant Musters had alluded.

Admiral COLLINSON said that he landed at Punta Arena in 1850, and, like Lieutenant Musters, was more struck at the immense breadth of shoulders of the natives than at their height. The same characteristic was as conspicuous among the women as among the men. No doubt, now that the country had once been traversed, many explorers would visit it; but he would recommend any intending emigrant to go a little further to the northward, instead of trying the Patagonian region.

Sir HARRY VERNEY said he visited the region between Buenos Ayres and Santiago 40 years ago, riding across the Pampas, and crossing the Andes, after the first snows had fallen, and when near the summits of the pass it lay 600 feet in depth. The number of cattle on the plains on both sides of the Cordillera was enormous. He was present at the branding of the young stock, the produce of the year, during a visit to a country house between Santiago and Conception. They were branded at the rate of a thousand cattle per day, ten days in succession. The horses seemed greatly to enjoy the sport. The country at that time was not in a very settled state, for the couriers who carried the mails would frequently, after leaving a town,

stay several days with any merchants who would bribe them, and so delay the dispatch of the mails.

Mr. CLEMENTS MARKHAM said the habits and customs of the Patagonians underwent a great change after the introduction of horses. When the Spaniards first visited the country, the natives used bows and arrows. Drake's chaplain described them as never cutting their hair, and as "using it as a storehouse for all the things they carry about: a quiver for arrows, a sheath for knives, a case for toothpicks, and what not." Pigafetta mentioned that the Indians at Port St. Julian brought with them some young guanacos, which they told the Spaniards they used as decoys. He says they used bows and arrows, and cloaks of skins. One of the voyagers in Drake's expedition mentioned their using a long pole covered with an immense quantity of feathers, sufficiently thick to conceal a man behind, by which they managed to stalk the ostriches. In 1530 the Spaniards formed a settlement on the River Plate, but afterwards they abandoned it for a time, not taking their horses with them. In 1580 the Viceroy, Don Francisco de Toledo, sent Sarmiento from Peru, who passed through Magellan Straits, and found the Indians mounted, having entirely abandoned the use of bows and arrows. It was very extraordinary that such a change should have taken place in so short a time. But the change in their habits was complete. From a people who stalked their game by using decoys, until within bow-shot, they became a race of horsemen, boldly chasing and running down their game in the open.

In answer to various questions—

Lieutenant MUSTERS said that there was considerable intercourse between the Manzaneros and the Valdivian and also the Araucanian Indians. He had no personal knowledge of the Coast Indians, whom he had heard described as a very inferior race, living on fish. From similarity of language, and other resemblances, he believed the foot Indians of Tierra del Fuego to be of the same stock as the southern Tehuelches. Between the Rio Negro and the Straits of Magellan there were about 560 fighting men, which would give a population of about 3000. This estimate did not include the tribes to the north of the Rio Negro, who probably were about as numerous as the Tehuelches. The population was decreasing both by rum and sickness. Many parts of the country abound with game: the chief animals being the guanaco, a kind of llama, rather bigger than the red deer, with a long neck and a woolly coat,—the call of the male guanaco resembling the neigh of a horse; the ostrich, a kind of emu, whose feathers were sold in the settlements; and the puma, very much like a large cat in appearance and habits, and about five feet long. These latter always ran away from horsemen. The meat of the guanaco and of the ostrich was very good. The pumas were also lassoed and eaten. The natives had no idea of any literature, but had wonderful memories. They did not worship idols; though they saluted the new moon, and asked blessings from any particularly beautiful place which they visited. They believed in a Good Spirit, though their active worship consisted in propitiating the Evil Spirit. He had heard the name Setebos as signifying a tutelary spirit of the caverns. He also stated that he had found an arrow-headed flint in Patagonia; but he thought it must have belonged to the old Indians who formerly inhabited the valley of the Rio Negro, because such flints were found chiefly in the camping-grounds of those tribes, and the flints probably were not more than two or three hundred years old.

Fourth Meeting, 9th January, 1871.

MAJOR-GENERAL SIR HENRY C. RAWLINSON, K.C.B., VICE-PRESIDENT, in the Chair.

ELECTIONS. — *J. D. Allcroft, Esq.; A. Campbell, Esq.; Henry Clifford, Esq.*, C.E.; *Captain R. Festing*, R.E.; *Theodore Galton, Esq.; J. H. Green, Esq.; Lieutenant A. Hamilton; Andrew Hay, Esq.; A. R. Nicols, Esq.; W. C. Pickersgill, Esq.; J. Pierce, Esq.*

ACCESSIONS TO THE LIBRARY FROM 13TH DECEMBER, 1870, TO 9TH JANUARY, 1871.—'Account of the Pelew Islands, 1803.' By H. Wilson. Donor A. G. Findlay, Esq. 'The Geography and Archæology of Peru.' By E. G. Squire. 1870. Donor the author. 'A Sketch of the Mountains and River Basins of India.' By Trelawny Saunders. 1870. Donors the India Office. 'Geographisch-Statistisches Lexikon.' Leipzig, 1864. Purchased. 'Ideas on our Military Position in a War with Russia.' By an Austrian Officer. Translated by the Topographical Department. 1870. Donors the War Office.

ACCESSIONS TO MAP-ROOM SINCE THE LAST MEETING OF DECEMBER 13TH, 1870.—North Polar Chart, to accompany Mr. Lamont's Register of Meteorological Observations in the *Diana's* two Voyages in 1869 and 1870. Presented by the author. Map of the Diamond and Gold Fields, S. E. Africa, showing the three main routes to them. Presented by W. B. Lord, Esq. Sheet No. 18, Bourges, of the Government Survey of France, Photo-zincographed at the Ordnance Office, Southampton. Presented by Sir H. James, R.E., Director. School Atlas, historical series, 31 Maps with Index. Presented by the author, A. K. Johnston, LL.D., Edinburgh. Map of the Sources of the Nile and its affluents, under the direction of Ismail Pacha-Kédive. By John Manuel, Membre de L'Institut d'Egypte, 1870. 238 Indian Maps, on 975½ sheets. From the India Office. This large addition nearly completes the collection of maps published by the Indian Government, as given in their catalogue. Presented by Her Majesty's Secretary of State for India.

On taking the Chair, Sir H. C. RAWLINSON, Vice-President of the Society, addressed the meeting as follows :—

"LADIES AND GENTLEMEN,—I have to announce to you that, in consequence of the continued illness of Sir Roderick Murchison, the Council of the Royal Geographical Society, with his entire concurrence, have invited me, as one of their Vice-Presidents, to accept the position and to discharge the functions of President *ad interim* until the anniversary meeting in May, when the Fellows of the Society, according to the regulations, will proceed to the election of an officer to fill the presidential chair for the ensuing two years. As I have been associated with Sir Roderick for the last twenty years in the work of the Royal

Geographical Society, no one can have had more favourable opportunities than myself of observing the singular felicity with which our venerated President has been enabled, owing to a rare combination of sound sterling knowledge with social tact and worldly wisdom, to conduct the fortunes of this Society from infancy to maturity; for he commenced with a very small nucleus both of members and of talent, and he has finished by placing this Society, in point of popularity and power—I may say also of general usefulness—at the head, or at any rate near the head, of the scientific Societies of the nation. No one can be more sensible than I am myself of my inferiority in point of scientific acquirements to our worthy President—no one can feel more acutely the hopelessness of attempting to emulate his social and administrative qualities; but at the same time I have thought it my duty to accept the invitation of the Council, and I do so in the hope that by earnestness and assiduity I may so perform the duties of President that the dignity of the office shall not deteriorate, nor the interests of the Society suffer, during this trying period of an interregnum. At the same time I must ask for your kind indulgence, if you observe any shortcomings on my part; I must ask you, indeed, to accord to me the same confidence and support which you have given to former Presidents, and without which no President can satisfactorily discharge the functions of his office. I do most sincerely congratulate the Society on our great good fortune in being enabled to meet in this magnificent hall. We are indebted for this great privilege to the liberality and public spirit of the Senate of the University of London, and it is therefore singularly appropriate that on this occasion our post-Christmas session should be inaugurated by a paper from the executive officer of that learned body, who has been himself mainly instrumental in obtaining this great privilege for us. Under any circumstances we should highly appreciate the advantage of meeting in a palatial hall like this, of such noble proportions and so brilliantly lighted; but the value of the favour is enhanced by the immediate contiguity of the site to our new premises in Savile Row. Every facility is thus afforded for the exhibition of maps and diagrams, and there is also a prospect, when our premises are completed, that we may adjourn, if the financial condition of the Society permits, after our ordinary meetings, across the road to our own rooms for refreshments and conversation. This is at present only a suggestion, but I throw it out for future consideration. There is only one other point on which I wish to say a word or two. Yesterday I had the pleasure of half an hour's conversation with Sir R. Murchison. I found him, although confined to an invalid-chair, as active-minded as ever, and as warmly interested as formerly in the proceedings and welfare of this Society. He begged me to assure you of the sincere gratification with which he had received the expression of your sympathy in his affliction and your earnest hopes for his recovery; and he also desired me to say that he sincerely congratulated you on being permitted to meet in this noble hall, as it was an arrangement which he had always had much at heart, and for which he had long and sedulously laboured. He particularly felt the disappointment of not being able to take his accustomed chair on such an auspicious occasion, but he said if anything could compensate him for that disappointment, it was the satisfaction he felt in the fact that the opening paper would be communicated by Dr. Carpenter, a gentleman who was a personal friend of his own, who was an accomplished physical geographer, and to whose exertions in our favour we are mainly indebted for the advantage of meeting in this hall. Sir Roderick further said, from what he had heard of the paper on the law of oceanic circulation, it appeared to him that if its conclusions were borne out by experiment, the announcement would rank, amongst the discoveries of physical geography, on a par with the discovery of the circulation of the blood in physiology."

The following paper was then read:—

On the Gibraltar Current, the Gulf Stream, and the General Oceanic Circulation. By Dr. W. B. CARPENTER, F.R.S.

INTRODUCTION.

Though requested by the President of the Royal Geographical Society, more than two years since, to bring before it some of the results of the Deep-Sea explorations in which I have recently taken part, I have hitherto been restrained from doing so by an indisposition to offer a mere *résumé* of communications previously laid before the Royal Society, to which, as the promoter of our Expeditions, it was proper that our Reports of them should be addressed.

It has happened, however, that some views in regard to a General Oceanic Circulation, which were indicated—rather than developed—in my Report of the *Lightning* expedition of 1868, and in my portion of the Report of the *Porcupine* expedition of 1869, have called forth strong opposition from men of such eminence as Dr. Petermann, Mr. Croll, and my friend and colleague Professor Wyville Thomson; who agree in attributing to the Gulf Stream the whole of that amelioration of the North Polar climate, which I believe to be chiefly due to a much larger, though less obvious, movement of Oceanic water. Now, the results of the *Porcupine* expedition of 1870 have not only furnished what appears to me very cogent additional evidence in support of the view I advocate, but have enabled me to give it a much more complete development. For I believe myself now able to show that the Physical theory which accounts for the double current in the Strait of Gibraltar and the Baltic Sound, would justify the prediction that a like surface-flow and reverse under-flow must take place in any Ocean that is freely continuous between the Equator and either Pole; which is exactly what the Temperature-soundings of the *Lightning* and *Porcupine* Expeditions appear to me to indicate. And as the question thus raised is one of high scientific interest, as well as of great practical importance, I have thought that I could not do better than submit to a Society that specially concerns itself with Physical Geography such a formal exposition of my views, as may enable them to be fairly and fully discussed by those who are best qualified to do so.

I wish to state *in limine* that I claim no originality whatever in advancing the doctrine of a General Oceanic Circulation sustained by difference of Temperature. It has been hinted at by various writers, especially Prof. Buff and Capt. Maury, though, so far as I am aware, it has not been formally propounded by any.* If I have myself done

* It seems to be imputed to me, by Mr. A. Keith Johnston, jun., that I advance as my own what is really Prof. Buff's; whilst, on the other hand, I am rebuked by

anything to strengthen the doctrine, it has been by showing that Polar Cold, rather than Equatorial Heat, is the *primum mobile* of this circulation; and further, by bringing a large number of phenomena, apparently unrelated, under the comprehension of the same Physical theory. If that theory can be shown to be in itself invalid or inapplicable to the facts of the case, and any more satisfactory explanation of those facts can be offered, I shall most gladly welcome it; having no other object to gain than the advancement of scientific truth. I ask only for a candid consideration of my arguments.

I.—GIBRALTAR CURRENT.

1. The designation "Strait of Gibraltar" is usually applied to the space bounded on the west by Cape Trafalgar and Cape Spartel, and on the east by the two "Pillars of Hercules," namely, Jebel Tarik, or the Rock of Gibraltar, on the European side, and Jebel Musa, or Apes Hill, on the Barbary coast. And although, as Admiral Smyth has justly remarked,* we should be justified in extending the designation to the whole of that funnel-shaped entrance from the Atlantic which is bounded on the west by Cape St. Vincent and Cape Cantin, I shall use it on the present occasion in its more restricted sense, as the phenomena I am about to describe were all presented within the limits first mentioned. The length of the Strait is about 35 miles; its width, which is about 22 miles at its western entrance, gradually diminishes to somewhat more than 9 miles between Tarifa and Alcazar Point, and then increases until it reaches 12 miles between Gibraltar and Ceuta, eastward of which the Strait terminates abruptly in the wide basin of the Mediterranean. The deepest portion of the Strait is at its eastern extremity; its depth, between Gibraltar and Ceuta, reaching 510 fathoms, and averaging about 400. From this the bottom gradually, but irregularly, slopes upwards as far as the western extremity of the Strait, where the shallowest water is to be found. The depth of the northern half of the channel, between Capes Trafalgar and Spartel, scarcely anywhere exceeds 50 fathoms; whilst its southern half does not seem anywhere to reach 200, and may be considered to average about 150. On the Atlantic side of this "ridge" the bottom gradually slopes downwards, until it reaches, at 25 miles to the west, a depth about equal to that found between

Mr. Croll for adducing the authority of Humboldt and Prof. Buff in my support. In my *Lightning* Report ('Proceedings of the Royal Society,' Dec. 17, 1868, p. 187) I cited exactly what Prof. Buff has said on the subject; and every one is quite free either to assign the doctrine to him, or to make me entirely responsible for it.

* 'The Mediterranean,' p. 158.

Gibraltar and Ceuta. This ridge, therefore, constitutes a kind of submarine "watershed," separating the inland basin of the Mediterranean from the great oceanic basin of the Atlantic.

2. Through the central part of this Strait a current almost invariably sets *eastwards*, or from the Atlantic into the Mediterranean. The *in*flow is most rapid in the narrower part of the Strait, where it usually runs at the rate of from *two* to *three* miles an hour; its rate sometimes rising to *four*, or even occasionally (as stated by Gibraltar pilots to Admiral Smyth) to *five;* whilst the current is sometimes so reduced in speed as to be scarcely perceptible, even giving place (though very rarely) to a contrary movement, or *out*flow from the Mediterranean towards the Atlantic. These variations are due to the action of winds and tides.

3. The constant current does not occupy by any means the entire breadth of the Strait, even at its narrowest part; its average width being there, according to Admiral Smyth, not more than 4 miles. On either side there is a stream, which when moving inwards is much less rapid, while its direction is periodically reversed under the influence of the lunar tide; so that at given times there are two lateral currents, the united force and amount of which, however, never approach those of the central inflow.

4. The rate of this central inflow diminishes immediately that it discharges itself into the Mediterranean basin, over the surface of which the Atlantic water spreads itself in virtue of its lower specific gravity. But the influence of the Gibraltar current is sensibly experienced along the Spanish coast as far as Cape de Gat, and along the African coast even as far as the Bay of Tunis; its force and direction, however, being greatly influenced by the winds that may happen to be prevalent.

5. The explanation of the Gibraltar current that has been most generally accepted is that originally given by Dr. Halley, who attributed it to the excess of evaporation from the surface of the Mediterranean over the whole amount of fresh water returned to it, either directly by rainfall, or by the rivers which discharge themselves into it; so that its level would be progressively lowered, if not kept up by the Atlantic inflow. The obvious objection to this explanation is, that as the water which passes off by evaporation leaves its salt behind it, and as the water which comes from the Atlantic brings its salt with it, there would be a progressive increase in the salinity of the water of the Mediterranean, which does not appear to be the case. This objection has been met by another hypothesis, viz., that although the *surface*-water of the

Mediterranean does not show more than a slight excess of saltness, there may be a great increase in the proportion of salt held in solution in the waters of its abyssal depths; and it has even been surmised that a deposit of salt may be taking place on its bottom. This hypothesis seemed to derive support from the analysis made by Dr. Wollaston, in 1828,* of a sample of bottom-water brought up by Admiral Smyth from a depth of 670 fathoms, at a point about 50 miles eastward of the Strait; which analysis gave the extraordinary percentage of 17·3 parts of salt, with a specific gravity of 1·1288, the percentage in ordinary Sea-water being about $3\frac{1}{2}$ parts, and its usual specific gravity between 1·026 and 1·027. But as two samples of Mediterranean water, taken respectively from depths of 450 and 400 fathoms, at distances of 680 and 450 miles eastward of the Strait, showed a density but little exceeding that of ordinary Sea-water, it was pretty clear that the first result was anomalous; and that, in whatever way it was to be accounted for, it did not represent the general condition of the deep water of the Mediterranean.

6. In the course of our recent Explorations, we collected numerous samples of Mediterranean water from various points of the surface, and from various depths, ranging downwards to 1743 fathoms. Our researches were almost entirely limited to the Western basin; but our deepest sample was taken from the Eastern basin, about 60 miles beyond Malta. The Specific Gravity of each sample was determined at the time by Hydrometers specially constructed for the purpose, and specimens of the most remarkable were brought home for verification with the Balance. The proportion of Chlorine in each sample was determined by volumetric analysis, which can be readily carried on aboard ship; and from this the entire proportion of salt may be estimated with considerable exactness. The Physical and the Chemical method of ascertaining the density of each sample gave results which generally accorded very closely.—Similar determinations had been previously made in regard to samples of water taken in the Atlantic, both from the surface and from various depths down to 1095 fathoms, during the voyage of the *Porcupine* from Falmouth to Lisbon.

7. A comparison of these results leaves no doubt that there *is* an excess of salinity in the water of the Mediterranean above that of the Atlantic; but that this excess is slight in the surface-water, whilst somewhat greater in the deeper water. The salinity of the deep-water of the Atlantic differs very little from that of its surface-

* 'Philosophical Transactions,' 1829, p. 29.

water, being sometimes a little greater, and sometimes a little less; but that of the deep-water of the Mediterranean is always in excess of the surface-water, the specific gravity increasing from 1·027 to 1·029, and the proportion of salt from about 3½ to about 4 per cent.*

8. Hence it seems a justifiable inference that the surface-evaporation from the Mediterranean exceeds the amount of fresh water returned into it; but that the increase of density which would result from the continual inflow of salt water to maintain the level, is in some way kept in check, probably through an efflux of the denser water by an under-current, as originally suggested by Dr. Smith, one of the earliest inquirers into the matter, in 1673. This is the view adopted by Sir John Herschel ('Physical Geography,' p. 28); and it has been considered to derive support from accounts that have been recorded from time to time, of vessels sunk in the narrower part of the Strait having floated up beyond its western entrance. But to these accounts no great importance is assigned by Admiral Smyth ('The Mediterranean,' pp. 154-157), who seems inclined to attribute these occurrences—if they really took place as narrated—to the action of the *lateral* surface-outflow.

9. The only objection that has been advanced, so far as I am aware, to the hypothesis of a westerly under-current, is based on the existence of the comparatively shallow "ridge," which (as already stated, § 1) crosses the western end of the Strait. The existence of this ridge, in the opinion of Sir Charles Lyell, "has dispelled the idea which was once popular, that there is a counter-current, at a considerable depth, in the Strait of Gibraltar, by which the water which flows in from the Atlantic is restored to that ocean."† But, as the depth of water on this "ridge" (§ 14) is much greater than the average depth of the British Channel, and as the under-current in the Baltic Sound flows very near the surface (§ 18), the validity of Sir C. Lyell's objection was fairly called in question by Captain Maury; who remarks: "To my mind, the proofs derived exclusively from reason and analogy are as clear in favour of this under-current from the Mediterranean, as they were in favour of the existence of Leverrier's planet, before it was seen through the telescope at Berlin."‡

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* I made a point of obtaining a sample from the precise spot (indicated by the recorded latitude and longitude) from which Admiral Smyth's anomalous sample had been taken; and found it not more saline than several other samples of deep water. It appears, therefore, that the specimen placed in Dr. Wollaston's hands (which had been some years in Admiral Smyth's keeping) must have undergone reduction to less than one-fourth of its bulk.

† 'Principles of Geology,' 10th ed., vol. i. p. 563.

‡ 'Physical Geography of the Sea' (1860), pp. 194-196.

10. I shall now concisely state the results of the inquiries made expressly to determine this point in the *Porcupine* Expedition of last summer.* These results were of a twofold character. It was our object in the *first* place to detect, if possible, by *mechanical* means, any movement which may be taking place in the deeper water, in opposition to the superficial inflow; and *secondly*, to determine by the temperature, the specific gravity, and the chemical composition of samples of water taken up at different points and from different depths, whether they belonged to the Mediterranean or to the Atlantic basin.

11. The *mechanical* method was entirely devised and carried out by my excellent friend, Staff-Captain Calver, with the practical ability for which he is distinguished. The *physical* and *chemical* observations, which were made under my own direction, gave results which harmonized completely with those of the mechanical, where both could be employed together, and supply a deficiency which the impossibility of applying the mechanical test on the uneven surface of the shallow ridge would otherwise have left in the proof of the outflow of Mediterranean water over it (§ 14).

12. Our investigations were first made in the mid-stream between Gibraltar and Ceuta, at nearly the narrowest part of the strait, and over a bottom of more than 500 fathoms' depth. It was conclusively proved by the action of Captain Calver's "current-drag" upon the boat from which it was suspended:—

(*a.*) That the current at 100 fathoms' depth flows *in*wards at less than half the rate of the surface-current.

(*b.*) That at 250 fathoms the direction of movement is completely reversed, the existence of an *outward* current being demonstrated by the dragging of the boat in direct opposition to the strong surface-current.

(*c.*) That at 400 fathoms there is still an *out*ward movement, though at a reduced rate.

13. Again, it was found by examining samples of water taken from the surface, from 100 fathoms, from 250 fathoms, and from 400 fathoms respectively, that, whilst the first two had the characteristic temperature and density of Atlantic water, the last two had the characteristic temperature and density of Mediterranean water; and it was specially remarkable that, whilst both the latter presented an excess alike in specific gravity and in the proportion of their saline constituents, which clearly indicated their derivation from the

* The details of these inquiries are contained in the Report of the Expedition, presented to the Royal Society, Dec. 8th, 1870, and published in its 'Proceedings.'

Mediterranean basin, the sample taken from 250 fathoms' depth was much denser than that taken from 400 fathoms.* It seems obvious that this heavier stratum could not be kept so near the surface, above a stratum of inferior density, by any other means than a *current* of no inconsiderable force.

14. Similar observations were afterwards carried on at the western extremity of the Strait, where its breadth is greatly increased, and its depth proportionably diminished. The soundings taken along the line of a transverse section between Capes Trafalgar and Spartel show a great inequality of the bottom; channels of from 150 to 190 fathoms' depth existing in the immediate neighbourhood of shallows less than 50 fathoms from the surface. As was to be expected from the greater breadth of this part of the Strait, we found the *in*current flowing at a much lower speed than at its eastern extremity, its rate being reduced from nearly 3 miles to little more than $1\frac{1}{4}$ mile per hour. The use of the "current-drag" at 100 fathoms' depth, in a part of the channel of which the depth was 147 fathoms, did not indicate any reduction in this rate; but a decided retardation showed itself when the current-drag was lowered to 150 fathoms, in a part of the channel of which the depth approached 200 fathoms. As Captain Calver deemed it inexpedient to lower the "current-drag" to a greater depth, since it would have been almost certain to "foul" on the rocky bottom, we were unable to ascertain by mechanical means that the stratum of water *immediately* lying over the ridge has the outward movement which it might be expected to show; but whilst the existence of such an *out*flow may be regarded as a necessary inference from the existence of a powerful outward under-current at the opposite extremity of the Strait, valid evidence in favour of it was afforded by the fact that the density of the water brought up from this stratum unmistakably indicated its derivation from the deeper part of the Mediterranean basin.

15. It is clear, therefore, that the water which has undergone concentration by evaporation is being continually carried back into the Atlantic by this westerly under-current, which causes it to

* It may be well for me to mention that this statement rests not on a single observation, but on multiplied observations. The facts were first noticed in our passage *into* the Mediterranean, when their significance was not understood, and no theory was built upon them. The information obtained during our Mediterranean cruise, led me to see the extreme importance of the fact, if it should be substantiated by further examination; and a second set of observations was accordingly made, with great care, on our return-passage through the Straits. The results of the two sets of observations were precisely accordant; and they have been further checked by the examination of samples of water from the 250 and 400 fathoms' depths, carefully preserved and brought home.

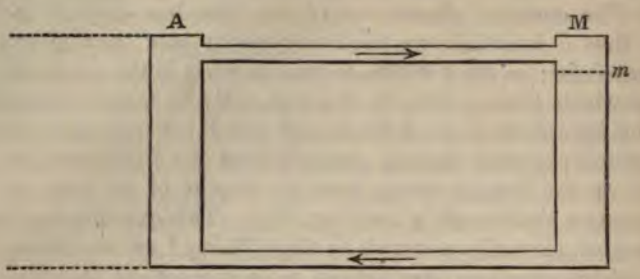
move up a gradual incline from the eastern to the western extremity of the Strait, so that the excess of density in the Mediterranean water is thus kept within a very narrow limit.

16. The essential phenomena of the Gibraltar current having been thus determined, we have to consider how they are to be accounted for; in other words, to inquire what is the source of the power which gives motion to the vast body of water continually flowing *in*wards from the Atlantic, and which not only gives motion to the under-current flowing *out*wards from the Mediterranean, but draws up the heavier water from the depths of its basin to the comparative shallow of its limiting ridge. This question has been, I conceive, correctly answered by Capt. Maury,* on the assumption —which our inquiries have proved to be correct—of the existence of an under-current; the immediate force in each case being *Gravity*, and the remote cause which brings it into action being *Solar Heat*. As the surface-level would be lowered by the excess of evaporation, it can only be maintained by an *in*flow. But, on the other hand, the maintenance of the level whilst the density of the Mediterranean water is in excess, disturbs the equilibrium between the columns of water at the two extremities of the Strait, the heavier water of the Mediterranean overbalancing the lighter water of the Atlantic; and thus a portion of the former is forced *out*wards as an under-current, thus again producing a depression of the level, to be restored by a surface inflow from the Atlantic. Now, since the Atlantic water which enters the Mediterranean is in its turn subjected to loss by evaporation and consequent increase of density, the excess on the Mediterranean side is constantly kept up; whilst, on the other hand, in consequence of the vastness of the mass of water in the Atlantic basin, and the dilution it receives elsewhere, the discharge of the heavier water of the Mediterranean produces no perceptible increase in *its* specific gravity. And thus, as the lowering of the level and the disturbance of the equilibrium are being constantly reproduced, the superficial *in*flow and the deep *out*flow will be as constantly maintained by the force of Gravity.

Thus, let M and A represent two columns, the one of Mediterranean and the other of Atlantic water: the former limited in diameter, so that its level and density are sensibly affected by excess of evaporation; the latter practically unlimited, so that any exchange of its own water with that of the Mediterranean does not sensibly affect either its level or its density. The two columns being originally of the same height and density, and being, consequently,

* 'Physical Geography of the Sea' (1860), pp. 186-197.

in equilibrium, let the *level* of the column M be lowered by evaporation to *m*; a surface *in*flow of salt water will then take place from



Diagrammatic Illustration of the Gibraltar Currents.

A to M for the restoration of the level. But since all the salt of the original Mediterranean column has been left in it, and the place of the *fresh* water it has lost is supplied by an influx of *salt* water, the whole quantity of salt in M will be increased, and thus its weight will come to exceed that of a corresponding column in A. This difference in the downward pressure of the two columns will cause an *out*flow of the lower portion of M into A, until the equilibrium is restored; but this outflow will in its turn renew the reduction in the level of M, which will be further lowered by the concentration of the water that has flowed in from A; and thus a fresh inflow will take place to keep up the level, and a further outflow to restore the equilibrium thus again disturbed.

17. It may conduce to the better understanding of this action, if we pause to consider what would be the result of a change in any of the conditions of its maintenance, thus:—

(*a.*) If the whole amount lost by evaporation from the surface of the Mediterranean were replaced by the *fresh* water of rain and rivers, there would be neither lowering of surface nor increase of density; consequently there would be *neither influx nor efflux* through the Strait of Gibraltar.

(*b.*) If, with the present excess of evaporation, the Atlantic were to supply *fresh* water instead of salt, there would be an *influx* through the Strait to the amount required to maintain the level; but there would be *no efflux*, since the equilibrium between the two columns would not be disturbed.

(*c.*) If, on the other hand, the quantity of *fresh* water discharged into the Mediterranean basin by rain and rivers were *in excess* of its evaporation, its level would tend to *rise*, whilst its density would tend to *decrease*. In that case there would be a *superficial efflux* of

the lighter water of the Mediterranean into the Atlantic; whilst, as the equilibrium would be continually disturbed in the opposite direction (the Atlantic column being then the heavier), an *under-current* of the denser Atlantic water would flow *inwards*.

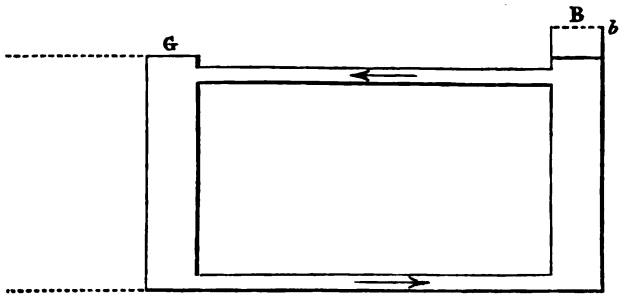
18. Now, this last hypothetical condition is precisely that of the Baltic in regard to the North Sea. The Baltic receives the drainage of one-fifth of Europe, and its evaporation is comparatively small; so that its level would be progressively raised, if the excess did not pass off by its three outlets—the Sound, the Great Belt, and the Little Belt—into the German Ocean. Now, just as the waters of the Mediterranean would gradually *increase* in saltness, if its density were not kept down by exchange with the Atlantic, so would that of the Baltic progressively *diminish* in saltness, by the washing-out of its shallow basin (so to speak) with river-water, if there were no return-current beneath, bringing back denser water from the German Ocean. But since we find, as a matter of fact, that its density is pretty uniformly the same, being about one-sixth that of ocean-water, it is obvious that there *must* be an under-current bringing back as much salt as is carried out by the surface-current. The force of this inferential proof could scarcely be increased by experimental verification. Such verification, however, has actually been obtained, as recorded by Dr. Smith, who first advanced the hypothesis of the Gibraltar under-current.* He states, on the authority of an intelligent seaman who took part in the experiment, that a boat having been taken into the mid-stream of the Sound, where it was carried along violently by the outward current, a bucket was sunk with a heavy cannon-ball to a certain depth of water, which gave a check to the boat's motion; and that on sinking the bucket still lower, the boat was driven to windward against the upper current. The surface-current seemed to be not more than four or five fathoms deep; and the under-current was found to increase in strength, the lower the bucket was let fall. This statement has recently been confirmed by Dr. Forchhammer;† who has obtained the comparatively dense water of the Kattegat from the bottom of the Sound, just as we obtained dense Mediterranean water from the deeper stratum in the Strait of Gibraltar. And he further mentions that a steamer having been sunk, some years since, by a collision near Elsinore, a diver who went down to save the passengers' goods found a strong current running towards the Baltic; and also that it is often observed that large deep-going vessels make their way

* 'Philosophical Transactions,' vol. xiv. p. 364.

† See his Memoir "On the Composition of Sea-Water," in 'Philosophical Transactions,' 1865, p. 231.

through the Sound against the surface-current, where smaller vessels do not succeed.*

19. The maintenance of this undercurrent in the Baltic Sound will be a necessary consequence of the constant inequality between the weights of columns of water of equal heights in the Baltic Sea and the German Ocean; not, as in the case of the Atlantic and the Mediterranean, through the increase of the specific gravity of the water in one column by continual concentration, but through the reduction in the specific gravity of the other by continual dilution.



Diagrammatic Illustration of the Baltic Currents.

Thus let B and G represent two columns, the one of Baltic, and the other of German Ocean water: the former limited in diameter, so that its level and density are sensibly affected by the surplus influx of fresh water; the latter practically unlimited, so that any outflow which takes place from the Baltic affects neither its level nor its density. The two columns being originally of the same height and density, and being consequently in equilibrium, let the *level* of the column B be *raised*, by an influx of fresh water, to *b*; this will cause a surface-outflow from B to G, for the restoration of the level. But since the *density* of the Baltic column has been *lowered* by admixture with fresh water, and a portion of its salt has been carried off by the surface-outflow, the restoration of the level will make the Baltic column the *lighter*; and the difference of downward pressure in the two columns will cause an inflow of the lower portion of G into B, until the equilibrium is restored. But this will, in its turn, renew the elevation in the level of B, which will be further raised by the continued influx of fresh water; and thus a renewed surface-*out*flow will take place to restore the

* This last circumstance has its parallel in the southward movement of icebergs, in opposition to the surface-drift of the Gulf Stream.

level, and a renewed deep *in*flow to restore the equilibrium.—The same is doubtless true in regard to the Euxine, which is continually discharging into the ocean by the Bosphorus and the Dardanelles currents the excess of water which is brought into it by the Don, the Dnieper, and the Danube, but of which the density is constantly maintained at about two-fifths the standard of Ocean-water. And the like explanation will apply to the still stronger case of the Sea of Azof, in which salt is always found, though in small proportion, notwithstanding that it is continually discharging at the Strait of Yenikale the vast body of water brought down into it by the Don. If there were no reflux of salt water beneath the surface out-currents, each of these basins would in time come to be occupied by fresh water only.

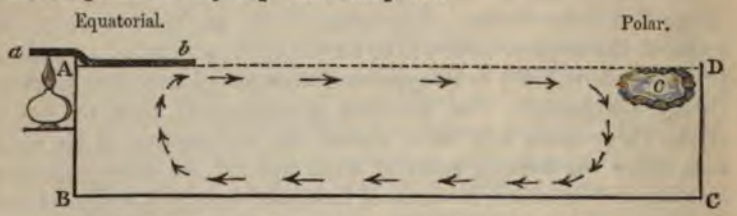
20. Since, then, Captain Maury's doctrine proves applicable, *mutatis mutandis*, to cases of which the conditions are exactly the reverse of those on which it was based in the first instance, it seems to me to present a strong claim to unhesitating acceptance; and I shall now proceed to develop the same fundamental principle in a much more extensive form.

21. A little consideration will make it obvious that a like circulation must take place in *any* case in which a want of Level and a want of Equilibrium between two columns of water are constantly maintained, whatever may be the agency concerned in disturbing them; and I shall now show that a constant difference in Temperature will have exactly the same effect as alteration of bulk and density by evaporation or dilution.

22. Suppose two basins of Ocean-water, connected by a Strait, to be placed under such different climatic conditions, that the surface of one is exposed to the heating influence of Tropical sunshine, whilst the surface of the other is subjected to the extreme cold of the sunless Polar winter. The effect of the surface-*heat* upon the water of the tropical basin will be for the most part limited (as I shall presently show, § 40) to its *uppermost stratum*, and may here be practically disregarded. But the effect of surface-*cold* upon the water of the Polar basin will be to reduce the temperature of its *whole mass* below the freezing-point of fresh water;* the surface-stratum sinking, as it is cooled, in virtue of its diminished bulk and increased density, and being replaced by water not yet cooled to the same degree. This warmer water will not come up from below (as it must do when the entire surface of a pond or lake is acted on by

* Sea-water does not expand, like fresh water, below 39°·5; but continues to contract down to its freezing point, which, if the water be undisturbed, is as low as 25°.

atmospheric cold), but will be drawn into the basin from the surface of the surrounding area; and since what is thus drawn away must be supplied from a yet greater distance, the continual cooling of the surface-stratum in the Polar basin will cause a "set" of water towards it to be propagated backwards (so to speak) through the whole intervening Ocean in communication with it, until it reaches the Tropical area. But since the *weight* of the Polar column undergoes no reduction with the lowering of its *level*, which results from the reduction of its temperature, the *in*flux of surface-water, which will take place from the Tropical basin to restore that level, will impart additional weight to the Polar column; and this will cause an *ef*flux of its cold deep water for the restoration of the equilibrium. So long, then, as the warm water which passes into the Polar basin from the Tropical is subjected to the cooling influence of its atmosphere, and is in its turn sent down to the bottom by the increase in its density, so long will the continual reduction of level keep up an influx from the Tropical basin; and so long as that influx is maintained, a corresponding efflux will take place from the bottom of the Polar basin into the bottom of the Equatorial. As the surface-water of the latter is constantly drawn off into the former, the water which has entered it from below is gradually lifted up by what follows it, and thus at last comes to the surface, where it is in its turn exposed to the heating influence of the Tropical sun, and is thence drawn off into the Polar basin, to repeat the same circulation. If the temperatures of these two basins were to be equalized, equilibrium would speedily be established through the whole system; but so long as one is heated (though only at the surface) and the other is cooled, so long will a Circulation such as I have described be maintained.—This is not a hypothesis merely, but is capable of easy experimental proof.



Experimental Illustration of the General Oceanic Circulation.

A B C D is a long narrow trough, with glass sides, filled with water nearly to its edge, as indicated by the dotted line A D. At A a thick metallic bar, *a b*, is so fixed that one part of it lies along the surface of the water, whilst the other, which projects beyond

the trough, is heated by a spirit-lamp placed beneath. At D a piece of ice, *c*, is wedged-in between the two sides of the trough. Thus the water in the trough is acted on by *surface-heat* at one end, like the water of the Equatorial ocean, and by *surface-cold* at the other, like the water of the Polar Sea. By the introduction of *blue* colouring liquid at the *surface* near D, and of *red* colouring liquid at the *bottom* near B, it is shown that a continuous circulation is kept up in the direction of the arrows:—the *blue* liquid, as it is cooled by the ice, at once descends to C, then travels slowly along the bottom from C towards B, gradually rises towards the heated bar, and thence creeps along the surface back towards D; whilst the *red* liquid first rises to the surface, then travels along it from A to D (taking the place of that which has descended), then itself descends to C on being cooled by the ice, returns along the bottom from C to B, and, lastly mounts again towards A.*

23. The case is not essentially altered by the existence of free communication between the two basins, through a large body of intermediate water; the principal difference in the result being that the movement in each direction will be slower, whilst it will affect a larger mass. The action of Cold on the surface-water of each Polar area will be exerted as follows:—

(*a*.) In diminishing the height of the Polar column as compared with that of the Equatorial, so that a lowering of its *level* is produced, which can only be made good by a surface-flow from the latter towards the former.

(*b*.) In producing an excess in the downward *pressure* of the column, when this inflow has restored its level, in virtue of the increase of Specific Gravity it has gained by its reduction of volume; whereby a portion of its heavy bottom-water is displaced laterally, causing a further reduction of level, which draws in a further supply of the warmer and lighter water flowing towards its surface.

(*c*.) In imparting a downward *movement* to each new surface-stratum as its temperature undergoes reduction; so that the entire column may be said to be in a state of constant descent, like that which exists in the water of a tall jar when an opening is made at its bottom, and the water which flows away through it is replaced by an equivalent supply poured into the top of the jar.

24. The ice-cold water thus pressed away from the Polar areas will travel along the floor of the deep Ocean-basins continuous with their own, beneath the warmer water which it encounters there, and with which it will undergo a certain intermixture at

* This experiment, by the kindness of Prof. Odling of the Royal Institution, was exhibited at the Meeting of the Royal Geographical Society.

their plane of junction; so that, as every fresh arrival will take its place beneath that which has preceded it, there will be a gradual *upward* movement of Polar water as it approaches the Equator, until it comes under the direct heating influence of the Tropical sun, to be again drawn towards the Poles by the tractive agency already described.

25. Here, then, we have a *vera causa* for a *General Oceanic Circulation*, which, being sustained simply by the unequal distribution of Solar Heat, will be entirely independent of any peculiar distribution of land and water that does not prevent the free communication between the Polar and Equatorial areas, in their depths as well as at their surface.—That this agency has been hitherto so little recognised by Physical Geographers,* I can only attribute to the prevalence of the erroneous idea of a uniform deep-water temperature of 39°; of which idea the observations made in the *Lightning* Expedition of 1868, confirmed and extended by those of the *Porcupine* Expedition of 1869, have completely proved the fallacy. Until it is clearly apprehended that Sea-water becomes more and more dense as its temperature is reduced, and that it consequently continues to sink until it freezes, the immense motor power of Polar Cold cannot be understood. But when this has been clearly recognised, it is seen that the application of *cold at the surface* is precisely equivalent as a moving power to that application of *heat at the bottom*, by which the circulation of water is sustained in every Heating Apparatus that makes use of it.†

26. Let us now inquire how far this theory is borne out by facts. In the first place, there is now ample evidence of the passage of

* Mr. Croll ('Philosophical Magazine,' Oct. 1870), in arguing against the doctrine of a General Oceanic Circulation sustained by difference of Temperature, and justly maintaining that such a circulation cannot be produced by the application of Heat at the surface, has entirely ignored this agency of Cold. And, whilst invoking the authority of Sir John Herschel against the idea that differences in Specific Gravity can be the cause of Ocean-*currents*, he altogether loses sight of the fact that, when Sir John Herschel maintained this view, he was a believer in the prevalence of a uniform deep-sea temperature of 39°, and further, that his objection does not apply to the slow movement, imperceptible to ordinary observation, which I advocate as the only explanation that appears to me possible of the temperature-phenomena of the North Atlantic. When Mr. Croll shall have accounted for the undercurrents in the Strait of Gibraltar and the Baltic Sound on any other principle than that of difference in Specific Gravity, he will be entitled to call in question the power of such difference to operate in producing a General Oceanic Circulation. But as the doctrine given above has been accepted as valid by some of the most distinguished Mathematicians and Physicists of this country, I must decline to recognise Mr. Croll's right to assume its fallacy.

† In the large heating-apparatus that warms the building of the University of London, the water leaves the boiler at about 120° (Fahr.), and returns to it at about 80°. Thus a difference of 40° is here sufficient to maintain the circulation through an extensive range of pipes, in which there will be considerable retardation by friction and change of direction.

Polar water at considerable depths beneath an upper and warmer stratum, not only into the Temperate but also into the Tropical zone. The indications of this fact previously obtained have been confirmed and extended, so far as regards the eastern part of the Atlantic, by the *Porcupine* Temperature-soundings of 1869; and also by the Temperature-soundings recently taken by Commander Chimmo and Lieut. Johnson in the Mid-Atlantic, as stated in my Report (pars. 113-119). And the Temperature-soundings recently taken by Commander Chimmo with the "protected" thermometers in Lat. 3° 18½′ S., and Long. 95° 39′ E., give 35°·2 as the bottom-temperature at 1806 fathoms, and 33°·6 at 2306 fathoms. Although the *Porcupine* temperature-soundings of 1870 were not carried down in the Atlantic to the great depths explored in the previous year, they brought into prominence this remarkable fact, that off the coast of Portugal there is a fall of *nine degrees* (namely from 49° to 40°) between 800 and 1000 fathoms; this being obviously the "stratum of intermixture" between the deep layer that has been cooled by the influx of Polar water, and the more superficial layer which has been heated by the Southern sun.

27. On the other hand, the surface-flow of Equatorial water towards the North Polar area is a fact universally admitted; and of its immense importance in moderating what would otherwise be the unbearable cold of that area, not the slightest doubt can be entertained by any one who makes himself acquainted with the evidence on this point recently collected by Dr. Petermann ('Mittheilungen,' 1870, p. 202). I do not in the least question the correctness of the conclusions which Dr. Petermann has drawn on this point from the mass of evidence which he has collected and correlated in his valuable Temperature-maps. What I question is the correctness of the doctrine that this north-east flow is *an extension or prolongation of the Gulf Stream*, still driven on by the *vis a tergo* of the Trade Winds,—a doctrine which (greatly to my surprise) has been adopted and defended by my colleague, Professor Wyville Thomson.* But whilst these authorities attribute the whole, or nearly the whole, of this flow to the true Gulf Stream, *I* regard a large part, if not the whole, of that which takes place along our own western coasts, and passes north and north-east between Iceland and Norway towards Spitzbergen, as quite independent of that agency; so that it would continue if the North and South American continents were so completely disunited, that the Equatorial current would be driven straight onwards by the Trade

* See his Lecture "On Deep-Sea Climates," in 'Nature,' July 28th, 1870.

Winds into the Pacific Ocean, instead of being embayed in the Gulf of Mexico, and driven out in a north-east direction through the "Narrows" off Cape Florida.

28. To the *mere* Physical Geographer * it may perhaps seem of little importance which of these views is the correct one. The transfer of a vast amount of heat from the Equator towards the Poles by a continual movement of water being admitted on both sides, the question whether the *so-called* Gulf Stream which warms Iceland, Spitzbergen, and the Polar area generally, is, or is not, an extension of the *real* Gulf Stream which issues from the Narrows, may seem scarcely worth discussing. But any one who takes a *scientific* view of the matter must see that the question is one of the highest interest, from its relation to the general theory of Ocean Currents, past as well as present. For if the doctrine of a General Oceanic Circulation depending only on differences of Temperature be correct, it comes in as an important element in the study of all other great currents at the present time, and especially of those of the southern Oceans, which seem much less attributable than those of the northern to the *primum mobile* of the Trade Winds, and indicate a general "set" of warm surface-water towards the Antarctic Pole, as pointed out by Capt. Maury ('Physical Geography of the Sea,' pars. 748-750), which is particularly noteworthy in a broad band that occupies in the Southern Hemisphere a position closely corresponding in longitude with the so-called Gulf Stream between Iceland and Norway, and carries an almost Equatorial temperature as far South as lat. 40°. Further, the question is of yet greater importance in its Geological relations; since any circulation that has its origin simply in difference of Temperature must have been maintained throughout all geological epochs; and the formation of Glacial beds, marked by the presence of the marine types of Polar waters, may have been taking place at any time and in any part of the Equatorial Ocean, without any reduction of the land temperature. Whereas if these glacial currents are originally dependent upon the motion communicated to the true Gulf Stream (as Prof. Wyville Thomson maintains †), they would cease to flow over the deep bed of the Atlantic, if the stream were diverted by the free passage of the Equatorial current into the Pacific.

29. In order, then, that the various points of contrast between the two doctrines may be clearly understood, I shall state them separately and explicitly. Their divergence may be said to commence at that part of the North Atlantic, in which, according to

* See Mr. Keith Johnston, Junr., in the 'Academy,' December 15th, 1870, p. 70.
† See his Lecture "On Deep-Sea Climates," in 'Nature,' July 28th, 1870.

the best authorities, the true Gulf Stream ceases to manifest itself as a definite north-easterly current; one large portion of it having been deflected southwards to return into the Equatorial current, whilst the remainder interdigitates with the opposing Arctic current, whereby its rate and temperature—already greatly reduced—are subject to such a further reduction, that, as Sir J. Herschel expresses it, the Gulf Stream *as such* is dispersed and destroyed.* This dispersion may be affirmed to be complete in about Lat. 45° N., and Long. 35° W.; to the north and east of which, according to the recently-published Admiralty Chart, no *movement* save a surface-drift is perceptible.† Between this part of the Atlantic and the western coast of Southern Europe, there is a region in which, as I shall presently show, there is no evidence of any other elevation of temperature than that which may fairly be attributed to the effect of the true Gulf Stream nearer its source, in heating the south-westerly winds that blow towards the whole Atlantic coast of Europe,—an effect very justly insisted on by Mr. Croll as an important element in the discussion of the total amount of work done by it. Passing from this *neutral* region, however, in which the Isothermal lines tend *southerly* rather than northerly, we find as we go Northwards more and more distinct evidence, from the *northerly* direction of the Isotherms, of the transference of heat, by a slow movement of water, in a north-easterly direction; this becoming so decided in the interval between Iceland and Norway, that the summer Isotherms—as shown in Dr. Petermann's Map for July—turn almost due north, and pass onwards in that direction, with more or less of an easterly bend, even beyond Latitude 75°. In connection with this phenomenon must be considered the under-flow of Polar water, which, as is admitted on both sides, brings back the surplus cold (so to speak) of the Polar area to the deep-sea bottom of the Equatorial zone.

(*a.*) Now on the one side the north-easterly flow of warm surface-water is affirmed to be a prolongation of the true Gulf Stream current, still urged on by the *vis a tergo* in which that current has its source, viz. the westward propulsion of intertropical water by the Trade Winds, constituting the Equatorial current; and the en-

* 'Physical Geography' (1861), p. 51. Sir John Herschel's statement as to the *thinning-off* of the Gulf Stream in this region has been fully confirmed by more recent observations.

† Of the prevalence of such a surface-drift there is ample evidence in the arrival of trees, fruits, and even floating shells (as *Spirula*) of the Tropics on the shores of the Hebrides, and the Shetland, Orkney, and Faroe islands. But of this drift the prevalence of south-west winds over that part of the Ocean seems a sufficient explanation.

trance of this water into the Polar area will be always tending to produce an *elevation* of its level.—On the view I advocate, this north-easterly flow is regarded as due to the *vis a fronte* originating in the action of cold upon the water of the Polar area, whereby its level is always tending to *depression* (§ 22).

(*b.*) So, on the one side, the return underflow of Polar water is considered as dependent on the Gulf-Stream current and its north-eastern extension, the water of which would *raise* the surface-level of the Polar basin, if this were not kept down by an escape from below, which, in its turn, is drawn into the Equatorial area to keep up the level that would otherwise be *lowered* by the flowing off of the Gulf Stream.—According to the doctrine here propounded, the deep efflux of Polar water is considered as the *primum mobile* of a General Oceanic *vertical* Circulation, of which the north-east surface-flow is the complement; whilst the Gulf Stream is part of a local *horizontal* circulation, which is completed by the direct return of a large portion of it into the Equatorial current, while the portion which proceeds farther north ultimately returns in the Polar surface-currents, of which the principal keeps its way southwards between the coast of the United States and the Gulf Stream, back to its very commencement.*

30. In discussing this question, I shall first endeavour to show that the portion of the Atlantic which lies between the Azores and the coast of Southern Europe is *thermometrically* a *neutral region;* the surface-temperature of which is that which normally belongs to itself in virtue of its geographical position, undergoing no sensible modification from the influence of the Gulf Stream, except that which is due to the remote influence of south-west winds, and therefore affording no evidence of the extension of any prolongation of the Gulf Stream into its area. The careful correlation which I have made of the surface-temperatures, taken every two hours through the day and night in our last *Porcupine* Expedition, shows most unequivocally that the surface-temperature of the Mediterranean during the months of August and September is on the average *at least five degrees higher* than that of the eastern border of the Atlantic between the same parallels. As I have not the same positive information in regard to the relative *winter* temperatures of

* In speaking ('Nature,' July 28th 1870), of a deep indraught of cold *Antarctic* water as required to keep up the level of the Equatorial area which is lowered by the northward flow of the Gulf Stream, Professor Wyville Thomson does not explain how the accumulation of water in the *northern* hemisphere is prevented. Moreover a reduction of level will give rise to a *surface*-current, rather than to a deep indraught.

these two Seas,* I must have recourse to a comparison between the temperatures of three stations on the Atlantic seaboard, and those of three stations within the Mediterranean in nearly the same parallels of latitude, as given in the Admiralty Pilot Charts for the Atlantic Ocean:—

COMPARATIVE TEMPERATURES.

ATLANTIC.

	Latitude.	Mean of Year.	November.	December.	January.	February.	Mean of Four Winter Months.
	° ′	°	°	°	°	°	°
Bordeaux	44 51	57·4	48	43	41	45	44·2
Lisbon	38 43	61·2	55	51	52	54	53·0
Cadiz	36 31	62·1	59	54	51	54	54·5

MEDITERRANEAN.

	Latitude.	Mean of Year.	November.	December.	January.	February.	Mean of Four Winter Months.
	° ′	°	°	°	°	°	°
Genoa	44 25	61·1	54	47	47	49	49·2
Palermo	38 7	63·0	59	55	51	51	54·0
Algiers	36 52	64·2	62	55	53	55	56·2

This comparison shows a decided excess in the Mean of the four winter months—as well as in the Annual Mean—in favour of the Mediterranean stations; and it seems a fair inference from this result that the temperature of the Atlantic seaboard of Southern Europe, between the parallels of 36° and 45° is *not perceptibly raised* by any afflux of Ocean water from a warmer source. It is no answer to this argument to urge that the winter temperatures of stations on the western shores of Europe are much higher than those of stations under the same parallels on the eastern sea-board

* Since this Paper was read, I have been referred by Mr. Prestwich to a Memoir by M. Aimé on the Temperature of the Mediterranean, in the 'Ann. de Chim. et de Phys.' for 1845; whilst the Hydrographer has been kind enough to furnish me with a set of Temperature observations in the Atlantic, contained in a Dutch work entitled 'Onderzoekingen met den Zeethermometer,' 1861. From these I have obtained the materials for the following comparison between the winter

of America; because it is beyond all doubt that the winter temperatures of St. John's, Halifax, Boston, New York, and Washington, are all abnormally *depressed* by the Polar current which intervenes between those stations and the Gulf Stream.

31. As we proceed Northwards, however, the evidence of the mitigation of winter cold by the transportation of heat from a southern source, through the agency of ocean-water, becomes more and more apparent. The reduction in the surface-temperature of the sea is much more gradual than the difference of latitude would lead us to expect; and the climate of the neighbouring land, especially in winter, is correspondingly ameliorated. And though a part of this amelioration is doubtless attributable, as Mr. Croll has pointed out, to the warm south-west winds, which carry towards the north-east the heat they have drawn from the *true* Gulf Stream in latitudes below 30°, there is clear proof that this is by no means the whole explanation of the phenomenon. For, as will be presently shown (§ 33), the excess of warmth in the sea that laves the north-western shores of the British Isles is by no means confined to the surface, but extends to a depth which no mere surface-heating could possibly account for. The influence of this northerly flow of water bringing warmth from a southern source, is peculiarly well shown by a comparison of the temperature of Stromness, on the one hand, with that of Greenwich, which is nearly $7\frac{1}{2}°$ further south; and, on

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temperatures of the Mediterranean at Toulon and Algiers, and those of the neighbouring part of the Atlantic under the same parallels:—

	N. Lat.	W. Long.	Temperature, deg. Fahr.			
			Dec.	Jan.	Feb.	Mean.
Toulon ..	43° 6′	5° 55′	57	53·8	53·4	54·7
Atlantic ..	43° to 44°	10° to 15°	55·2	55	53·8	54·6

	N. Lat.	Long.	Temperature, deg. Fahr.			
			Dec.	Jan.	Feb.	Mean.
Algiers ..	36° 52′	3° 2′ E.	60	57·6	56	57·8
Atlantic ..	36° to 37°	10° to 15° W.	61	58·8	58·8	59·5

The mean winter surface-temperature of the Mediterranean at Toulon is therefore exactly the same as that of the Atlantic under the same parallel; while that of the Mediterranean at Algiers is only 1° 7′ lower,—a difference quite insufficient to show that the Gulf Stream produces any thermal elevation of temperature in this part of the Ocean.

the other, with that of Christiania and Stockholm, which are nearly in the same parallel of latitude with itself. All these stations are within the warming influence of the south-west winds, and they are all exposed to the moderating influence of a neighbouring sea. But whilst Stromness lies in the direct course of the north-east flow (commonly regarded as a continuation of the Gulf Stream), Greenwich, Christiania, and Stockholm, are secluded from its direct influence.

	Latitude.	Annual Mean.	Winter Temperature.				Mean of Four Winter Months.
			Nov.	Dec.	Jan.	Feb.	
	°	°	°	°	°	°	°
Stromness	58 58	46·2	43	41	38	38	40·0
Greenwich	51 30	49·0	43	41	35	37	39·0
Christiania	59 53	41·5	32	27	21	22	25·5
Stockholm	59 22	42·2	35	27	24	27	28·2

Here we see that, with a difference of latitude of nearly $7\frac{1}{2}^{\circ}$, the *mean annual* temperature of Stromness is only 2°·8 lower than that of Greenwich, whilst its temperature during January and February is decidedly milder. On the other hand, Stromness has an enormous advantage over Christiania and Stockholm in winter temperature, though the greater heat of their summer prevents this advantage from being so marked in the annual mean.

32. The evidence of the mitigation of Arctic cold by the transportation of Southern heat, in the north-east flow of Ocean-waters becomes stronger and stronger the further North the effects of that flow are traced. And I shall now endeavour to show that this mitigation is due to the *General Oceanic Circulation*, the existence of which it has been my aim to demonstrate on the ground of physical necessity, and the special applicability of which to the case in question I shall now point out.

33. The Temperature-soundings taken in the *Lightning* Expedition of 1868, and the *Porcupine* Expeditions of 1869 and 1870, clearly establish (1) that the north-east movement of Ocean-water is not a mere surface-flow, but extends to a depth of several hundred fathoms: and (2) that its transportation of warmth is even more marked in its lower than in its upper strata,—the surface-tempeture falling with that of the air, whilst the temperature of the deeper water suffers a much smaller reduction in its northerly course. These facts must, I think, become evident to any one who will carefully study the observations contained and digested in the

'Preliminary Report of the *Porcupine* Expedition of 1869;'* and I shall here only give such a sample of those observations as will show their important bearing on the question before us. What may be designated as *serial* soundings having been taken at particular stations to ascertain the rate of descent of Temperature with progressive increase of Depth, I select for comparison the two series between which the difference of latitude was the greatest; namely, No. 87, which was taken at a point about 140 miles to the north-west of Scotland, and No. 42, taken at a point about 200 miles to the south-west of Ireland, the difference of latitude between them being rather more than 10°.

No.	N. Lat.	Temperature of Air.†	Temperature of Sea.					
			Surface.	100 Fath.	200 Fath.	300 Fath.	400 Fath.	500 Fath.
	° ′	°	°	°	°	°	°	°
87	59 35	54	52·6	47·3	46·8	46·6	46·1	45·1
42	49 12	66	62·6	51·1	50·5	49·6	48·5	47·4
Difference ..		14	10·0	3·8	3·7	3·0	2·4	2·3

Here we see that, with a reduction of 12° in the temperature of the Air at the northern station, there was a reduction of 10° in the heat of the surface-water; but that at 100 fathoms the difference is only 3°·8; and that the difference in the temperature of the deeper water between the two stations goes on decreasing, until, at 500 fathoms it is only 2°·3. Now, whether or not we attribute to the Gulf Stream the elevation of the surface-temperature in either or both of these cases,‡ it seems to me clear, from the very slight difference between the temperatures of the 400 fathoms beneath in latitudes 49° and 59° respectively, and from the great excess shown in the latter parallel above what may be considered as its normal isotherm, that the whole of this mass of water must have been derived from a southern source and must be travelling

* 'Proceedings of the Royal Society,' vol. xviii. p. 453.

† The temperatures of the air are not those of the particular hours at which the soundings were taken, but the daily averages in the two localities.

‡ I cannot myself doubt that the surface-temperature at No. 42, high as it may seem for the latitude, was due to the direct action of the summer sun, and was not imported from a southern source. For the weather had been very fine for some time previously, and the action of the sun very powerful; and the rate of declension through the first 100 fathoms from the surface downwards corresponded closely with that which was observed during the Mediterranean cruise of the *Porcupine* in 1870 (§40).

slowly northwards. Further, a comparison of the serial sounding at Station 42 with the *bottom* temperature-soundings taken in the *Porcupine* Expedition of 1870 off the coast of Portugal, about 10° further south, affords similar evidence, in the correspondence of the rates of reduction from the surface downwards, that this northerly flow of a stratum at least 500 fathoms deep is traceable southwards to what I have designated the "neutral area" (§ 30).

N. Lat.	Temperature of Air.	Temperature of Sea.					
		Surface.	100 Fath.	200 Fath.	300 Fath.	400 Fath.	500 Fath.
° ′	°	°	°	°	°	°	°
49 12	66	62·6	51·1	50·5	49·6	48·5	47·4
About 39°	70	68·0	53·0	52·0	51·5	51·0	50·5

A comparison of these data brings into marked prominence the superior heating power of a deep mass of warm water, above that of a mere surface-layer. For we see that whilst the temperature of the upper stratum is rapidly cooled down in its northward passage, that of the 400 fathoms beneath it sustains comparatively little reduction. The thinned-out margin of the Tropical Gulf Stream would lose all its heat long before it reaches the Polar Circle; but the deep flow which carries northwards the warmth of a Temperate area yields it up far more gradually.

34. I cannot myself see how the movement of such a mass is to be accounted for on the hypothesis that its impelling force is derived from the surface-action of the thinned-out margin of the true Gulf Stream; but as my colleague, Prof. Wyville Thomson, interprets the fact (as to which there is no difference between us) in that sense, it is requisite for me to state why I cannot agree with him. "The basin of the North Atlantic," he says (*loc. cit.*) "forms a kind of *cul de sac;* and while a large portion of the Gulf-Stream water, finding no free outlet towards the north-east, turns southwards at the Azores, the remainder, instead of thinning-off, has rather a tendency to accumulate in the northern portions of the trough. We accordingly find that it has a depth, off the west coast of Ireland, of at least 800 fathoms, with an unknown lateral extension." Further, he says, in "the Shallow, including the Hebrides, the Orkney and Shetland Islands, and the Faroes, stretching westwards and northwards nearly to Iceland, the average depth is about 500 fathoms; and the Gulf Stream, which has a depth in these latitudes in summer of from 600 to 700 fathoms, occupies

the whole of it, giving an abnormal temperature of something like 12°." Now, the temperature-soundings taken by Commander Chimmo in the neighbourhood of the Banks of Newfoundland clearly show that the thickness of the Gulf Stream does not there exceed 50 fathoms, and that it may be less. Thus, in Lat. 44° 3′ N., and Long. 48° 7′ W., the temperature of the surface-water being 61°, it was reduced at 50 fathoms' depth to 43°; whilst at 1000 fathoms it was 35°·5.* Between this part of the Atlantic and its north-eastern border, with which we are now concerned, there is an area, calculated by Mr. Findlay at 1,500,000 square miles, over which this thinned-out margin of the Gulf Stream is free to diffuse itself still more widely. And it is to me physically inconceivable that this surface film of *lighter* (because warmer) water should collect itself together again—even supposing it still to retain any excess of temperature—and should burrow downwards into the "trough," *displacing colder and heavier water*, to a depth much greater than that which it possesses at the point of its greatest "glory"—its passage through the Florida Narrows. The upholders of this hypothesis have to explain how such a re-collection and dipping-down of Gulf-Stream water is to be accounted for on Physical principles.

35. Now, the slow onward northerly movement of the whole mass of Ocean-water above that "stratum of intermixture" which intervenes between the upper Equatorial-polar flow and the deeper Polar-equatorial flow, is exactly what would be anticipated on the hypothesis of a Vertical Circulation, kept up by the opposition of Temperature between the Polar and Equatorial oceanic areas. Its rate, estimated by Admiral Irminger at from $1\frac{1}{2}$ to $2\frac{1}{2}$ miles per day,† is what may be expected on that hypothesis; whilst it is much less than that which the re-collected waters of the Gulf Stream ought to possess, in order to maintain their ground against the weight of colder water which they displace. I venture to urge, therefore, that the admitted existence of the northward "set" of this great body of warm ocean-water, taken in connection with the return-flow of Polar water already adverted to (§ 26), affords very strong evidence in favour of a general *vertical* Oceanic circulation.

36. Of such a Circulation the most remarkable example that has

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* 'Proceedings of the Royal Geographical Society,' for February 8th, 1869.—The temperature recorded by Commander Chimmo at 1000 fathoms was 39°5; but this needs to be reduced by a correction of about 4° for the effect of pressure at that depth upon unprotected thermometers.

† 'Proceedings of the Royal Geographical Society,' vol. xiii. 1869, p. 227.

yet presented itself was first discovered in the *Lightning* Expedition of 1868, and was more fully examined in the *Porcupine* Expedition of 1869; in which a great number of temperature-soundings were taken, that brought out very clearly the contrast in submarine climate produced by it in what I had ventured to designate as the Warm and Cold Areas.* The nature of this contrast will be readily understood from a comparison of the two serial soundings (Nos. 52 and 64) taken in the Cold Area, with the one already cited (No. 87) taken in the Warm Area: No. 52 being about 50 miles to the northward of No. 87; whilst No. 64, which was taken in the middle of the channel dividing the Shetland and the Faroe Islands, was nearly a degree northward of No. 52.

	No. 52. Lat. 60° 25′.	No. 87. Lat. 59° 35′.	No. 64. Lat. 61° 21′.
	°	°	°
Temperature at surface	52·1	52·6	49·7
,, at 50 fathoms	48·5	48·1	45·5
,, at 100 ,, ...	47·3	47·3	45·0
,, at 150 ,, ...	46·5	47·0	43·3
,, at 200 ,, ...	45·6	46·8	39·6
,, at 250 ,, ...	38·4	..	34·3
,, at 300 ,, ...	30·8	46·6	32·4
,, at 350 ,, ...	30·6	..	31·4
,, at 400 ,, ...	..	46·1	31·0
,, at 450 ,, ...	..	..	30·6
,, at 500 ,, ...	..	45·1	30·1
,, at 550 ,, ...	..	..	30·1
,, at 600 ,, ...	..	43·0	29·9
,, at 640 ,, ...	..	..	29·6
,, at 700 ,, ...	..	..	
,, at 767 ,, ...	..	41·4	

Between the temperatures of the surface and of the upper stratum down to 200 fathoms in Nos. 52 and 87, there is an extraordinarily close correspondence; but whilst, in the latter, reduction goes on gradually with the depth, there is in the former a sudden descent of nearly 15° between 200 and 300 fathoms; so that the temperature of the bottom at 384 fathoms is reduced to 30°·6. In No. 64 we find the temperature of the surface and of the upper stratum lower throughout, and the reduction commences earlier and goes on more gradually; but at 300 fathoms a temperature of 32°·4 was reached, and a further reduction showed itself with increase of depth, until at 640 fathoms a temperature of 29°·6 was marked. From these comparisons it seems clear, that whilst the upper stratum overlying the

* See the 'Preliminary Report' already referred to.

Cold Area is a continuation of the warm flow which has made its way into this region from a southern source—rapidly losing heat as it passes northwards—the Glacial stratum beneath has been brought by some peculiarity of the bottom (like that which causes the deeper and heavier stratum of Mediterranean water to ascend the slope forming the bed of the Strait of Gibraltar, § 15) much nearer the surface than it lies elsewhere in that latitude.

37. That this Glacial stratum is really a *stream*, moving slowly onwards towards the south-west to discharge itself into the Atlantic basin, I cannot bring myself to doubt; although the point is contested by my Colleague, apparently on the ground that we did not trace its further course. "At the western mouth of the valley," he says, "the cold water is banked in and retained by the water of the Gulf Stream, which is slowly passing the entrance of the gorge; giving a repetition on a small scale of the curious phenomenon described by Professor Bache, off the coast of Massachusetts, as the 'cold wall.'" Now these two cases are by no means parallel. The Polar surface-current running southwards along the Atlantic sea-board of the United States, and the Gulf Stream running northwards, between which the "cold wall" intervenes, *move past* one another in opposite directions, as thus: $\overrightarrow{\text{Cold Wall.}}$ But the warm and cold streams in the region which Professor Wyville Thomson and I have explored together, are moving *towards* one another in opposite directions, Warm $\rightarrow$ Cold $\leftarrow$; the *warm* stream from south-west to north-east, the *cold* stream from north-east to south-west. The *upper* layer of the warm stream passes *over* the cold stream, in virtue of its inferior specific gravity; and the analogue of the "cold wall" is here the "stratum of intermixture" between 200 and 300 fathoms' depth. Supposing that the cold stream were "banked in" by the *lower* stratum of the warm stream, its motion would be *checked* if the opposing forces of the two streams were equal, and *reversed* if the onward force of the warm stream were the greater. In either case the bottom would cease to show its glacial temperature; for the lower stratum in immediate contact with it would come to possess, if reduced to *stagnation*, the normal temperature of the latitude; whilst the *reversal* of the flow would bring up its temperature to that of the Warm Area. That we did not hit upon the outlet to this cold stream is, I believe, due to the smallness of the number of our soundings to the west of Long. 8° 10′, the most westerly point to which we traced it. It was at this point (No. 52) that there was the most distinct evidence of the *movement* of the stream, in the

rounding of the gravel pebbles brought up from its bottom; and this seemed coincident with a narrowing of its channel, probably through the agency of a "middle bank."*

38. Here, then, we seem to have a sort of epitome, within the comparatively moderate depth of 384 fathoms, of that *surface* Equatorial —> Polar flow, and of that *deep* Polar —> Equatorial flow, which, in the great Oceanic basins, can only be substantiated by Temperature-soundings reaching to more than 1000 fathoms, but of which all such soundings that can be regarded as at all reliable, afford very distinct indications,† as I have shown in Pars. 118-121 of the 'Preliminary Report' of the *Porcupine* Expedition of 1869.

39. Having thus fortified my own position, by showing that the power I have invoked has a real existence and a most extended and varied operation, instead of being a figment of my own imagination (as Mr. Croll represents it‡), I shall venture to attack the stronghold of my adversaries, by showing that the Gulf Stream, at the point of its greatest "glory," can by no means claim the heating power which they assign to it.

Thermal Work of the Gulf Stream.

39. "From an examination of the published sections some years ago," says Mr. Croll, "I came to the conclusion that the total quantity of water conveyed by the Stream is probably equal to that of a stream 50 miles broad and 1000 feet deep, flowing at the rate of 4 miles an hour; and that the mean temperature of the entire mass of moving water is not under 65° at the moment of leaving the Gulf."§ The correctness of this estimate has been already called in question by Mr. Findlay,‖ who has shown that it is by no means justified by the data supplied by the American

* I am authorised by Captain Calver, whose practical knowledge of all matters relating to currents entitles his judgment on this question to the greatest weight, to state that he entirely concurs in the interpretation I have given in Pars. 35–37 of the phenomena we have observed together.

† Since this Paper was read, I have received, by the kindness of Sir Henry Rawlinson, the following very interesting communication from Mr. Newall of Gateshead:—"In laying the Atlantic Cable of 1865, it is recorded that a red painted buoy, with a ball and flagstaff, was dropped on August 4th, in lat. 51° 28', long. 38° 42', to mark the broken end of the cable. This buoy was last seen by the West India Mail Steamer *Mexican*, on October 19th, 1865, in Lat. 42°, Long. 40°, when it appeared to be stationary; so that in seventy-six days it had travelled *nearly due south* about 600 nautical miles, or about 8 nautical miles a day. I presume that the buoy had been thus carried against the Gulf Stream by a strong undercurrent acting on the long buoy-rope."

‡ 'Philosophical Magazine,' October, 1870. See also the note *ante*, pp. 54, 55.

§ 'Philosophical Magazine,' February, 1870.

‖ 'Proceedings of the Royal Geographical Society,' February 8, 1869.

surveyors. I have now to show that the data obtained during the *Porcupine* Expedition of 1870 may be fairly used as the basis of a still further reduction.

40. According to the mode of computation adopted by Mr. Croll, the *total amount of water* entering the Mediterranean from the Atlantic through the Strait of Gibraltar would be estimated by the sectional area of the channel between Gibraltar and Ceuta, and the rate of the surface-current, moving 3 miles an hour, at that point. Previously to our recent exploration, no one could have been justified in affirming that such an estimate is excessive; and yet we now know that it would have been egregiously wrong. For, as already shown (§ 12), the rate of inflow quickly diminishes from the surface downwards, so that at the depth of 200 fathoms there is probably "dead water"; whilst below 250 fathoms the movement is all *in the opposite direction*. I think that I should not under-estimate the real amount of the inflow if I were to take it at not more than *one-tenth* of the entire sectional area, moving at the rate of 3 miles per hour. No experiments have been made by the American surveyors of the Gulf Stream, so far as I am aware, for the purpose of ascertaining its rate and direction at different depths, in the narrowest—which is also the shallowest—part of its course, the strait between Cape Florida and the *Bemini* Isles; and until such experiments shall have proved the contrary, it may be affirmed that the assumption that the surface-rate prevails at even an inconsiderable depth,—much more that it extends through the entire sectional area,—must be considered as a pure assumption. For, it must be remembered, the action of the Trade Winds in producing the Equatorial Current is a *superficial* one; and there is no evidence that it sets in rapid motion any deep stratum of water. And even if the whole mass of water in the Narrows really flows in the same direction, there is every probability that the rate of its movement rapidly decreases from the surface downwards,*—the case being entirely different from that of a stream descending through a channel of which the bed progressively falls. But, further, the low temperature which has been ascertained to exist in its deepest stratum, is to me a very strong indication that there is *an undercurrent in the opposite direction*, bringing comparatively cold water into the Gulf of Mexico from the Polar current, which has been traced southwards to near the mouth of the Narrows. The existence of such an undercurrent is hinted at by the American surveyors themselves, in consequence of the distinct evidence they have obtained

* Here, again, I am permitted to cite the authority of Captain Calver in support of my position.

of an almost glacial temperature beneath the heated waters of the Gulf Stream, both within the Gulf of Mexico and after its exit from the Narrows. In the present state of our knowledge, no one has any right to *deny*, any more than I have to *affirm*, the existence of such a reverse undercurrent; but, until its existence shall have been *dis*proved by actual observation, the analogy of other currents between gulfs or inland seas and the open ocean must be held to be in its favour.

40. In regard to the *average temperature* of the mass of moving water, the data supplied by the observations made last summer during the Mediterranean cruise of the *Porcupine* lead me to regard Mr. Croll's estimate as far too high. It seems based on the assumption that, in proceeding from above downwards, the temperature descends uniformly between the different points of observation—as in the section between the Florida Keys and the Havana—from 80° or 84° at the surface, to 60° at about 350 fathoms, and to 45° on the bottom at 845 fathoms. Now, three sets of observations in the Mediterranean, made at intervals of ten fathoms, show that the *superheating*, produced by the direct action of the sun upon the surface, is almost entirely limited to a stratum of *fifty* fathoms' depth, the descent of the thermometer being most marked in the first *twenty* fathoms, as shown in the following Table:—

	I.	II.	III.
	°	°	°
Temperature of air	74·3	75·0	78·3
,, of surface	69·5	74·5	77·0
,, at 10 fathoms	59·0	69·3	71·0
,, at 20 ,, ...	57·5	65·0	61·5
,, at 30 ,, ...	56·5	63·0	60·0
,, at 40 ,, ...	55·7	61·7	57·3
,, at 50 ,, ...	55·3	59·7	56·7
100	54·7	55·1	55·5

It is reasonable thence to infer (until evidence shall be adduced to the contrary) that a more rapid reduction from the surface-temperature would be found in the uppermost stratum of the Gulf Stream than in that which lies below it; so that any computation founded upon a uniform relation between temperature and depth is altogether erroneous. As the Mediterranean is altogether cut off from the Oceanic circulation, no data can be drawn from the temperature of its deeper water, which, from 100 fathoms downwards to the greatest depths we sounded—1508 fathoms in the western basin, and 1743 in the eastern—proved to be perfectly uniform.

But, in our Atlantic soundings in a corresponding parallel of latitude, we found that, after passing through the heated surface-layer, there was a slow, nearly uniform, descent of temperature down to the "stratum of intermixture," in which there was another sudden drop of 10°. And, as it is clear from the reduction of temperature of the Gulf Stream to probably *less* than 45° at its bottom, that a stratum of water, cooled by admixture with a Polar current — whether moving inwards or outwards—underlies the warm stream, analogy justifies the suspicion that there may be a sudden reduction from 60° to 45° at no great depth below that at which the former temperature was obtained. At any rate it may be affirmed with confidence that, until a much more minute and accurate series of observations than any yet made * shall have determined the temperatures of different strata of the Gulf Stream, no reliable calculations can be even approximately made as to the amount of heat conveyed by it.

41. Since, then, Mr. Croll's estimate of the thermal work done by the Gulf Stream has been shown to be unreliable—in regard alike to the *amount of water* which daily flows outward through the Narrows, and the *amount of heat* which that water conveys,—and since the excess of his estimate (if the facts should prove to be accordant with the analogies I have adduced) will be in the *compound ratio* of the reductions which may have to be made in the two elements—I submit that no argument can be fairly based on that estimate against the doctrine of the General *vertical* Oceanic Circulation, on the ground that the Polar area is so effectually heated by the Gulf Stream that there is nothing left for any more general circulation to do.†

SUMMARY.

The *Physical Principles* on which the argument of the foregoing Paper is based, may be stated as follows:—

I. Wherever there is a *difference of level* between two bodies of water in communication with each other, there is a tendency towards the equalization of their levels by a flow of the *upper stratum* of the higher towards the lower.

II. So long as the difference of level is maintained, so long will this flow continue; and thus any agency which constantly lowers

* I am justified by the information I have personally received from Mr. Hilgard, under whose direction the observations above cited were made, in affirming that the Temperatures taken at considerable depths are by no means to be relied on, and that the whole of this work has to be done over again with *protected* Thermometers, such as were used in the *Porcupine* Expeditions.

† See his Paper "On the Physical Cause of Ocean Currents," in 'Philosophical Magazine,' October, 1870.

the level of one body of water below that of the other (unless it directly antagonize the downward pressure of the higher water *), will keep up a constant flow from the higher towards the lower. This constant *tendency to equalisation of level* will restrain the actual difference within very narrow limits; and the movement, when there is free communication, will be proportionally slow.

III. Wherever there is a *want of equilibrium*, arising from *difference of density*, between two bodies of water in communication with each other, there is a tendency towards the restoration of equilibrium by a flow from the *lower stratum* of the denser column towards that of lighter, in virtue of the excess of pressure to which the former is subjected.

IV. So long as a difference of density continues to exist, so long will this flow continue; and thus any agency which constantly produces a fresh disturbance of equilibrium, whether by increasing the density of one column or by diminishing that of the other, will keep up a continuous flow from the denser towards the less dense. This constant *tendency to restoration of equilibrium* will keep the actual difference of density within definite limits.

V. If there be at the same time a *difference of level* and *an excess of density in the shorter column*, there will be a simultaneous tendency to the equalization of the *level* by an *upper flow from the higher to the lower*, and to the restoration of the *equilibrium* by an *under flow from the heavier to the lighter column.*

VI. So long as the *difference of level* and the *difference of density* are maintained, so long will the flow continue in each direction; and thus a *Vertical Circulation* will be kept up by any constant agency which alters at the same time the level and the density; provided that the excess of density always remains on the side of the lower column.

VII. The rate of flow, where it is not confined within narrow limits, will depend simply on the amount of disturbance, in the one case of *level*, and in the other of *density*; and when this disturbance is small, so as to be counteracted almost as soon as it takes place, the movement may be so slow as to be almost imperceptible, though not less real and effectual. But if the communication between the

* Thus, it has been shown by Archdeacon Pratt ('Phil. Trans.,' 1859), that in consequence of the local attraction produced by the high land of Asia, with nothing but Ocean to the southward, the Sea-level at the mouth of the Indus is no less than 5·5 feet above that at Cape Comorin.—So, again, if barometrical pressure be *permanently lower* over any Oceanic area, than on other parts of the surface, there will be a *permanent elevation* of the water-level in that area, but *no current*; equilibrium being there maintained when the *excess* of Water-pressure is equal to the *deficiency* of Air-pressure.

two bodies of water take place through a long narrow channel, the rate of movement will increase so as to produce a decided current in each direction; since the moving force, which in the former case is diffused through a vast body of water, is here brought to bear upon a limited amount, and will act as a *constantly accelerating* one, increasing the rate of motion until any further augmentation is checked by opposing forces.

The *application* of the foregoing Principles to the particular Cases discussed in the Paper is as follows :—

VIII.—A Vertical Circulation is maintained in the Strait of Gibraltar by the *excess of evaporation* in the Mediterranean over the amount of fresh water returned into its basin, which at the same time *lowers its level* and *increases its density;* so that the *surface-inflow* of *salt* water which restores its level (exceeding by the weight of salt contained in it the weight of fresh water which has passed off by evaporation) disturbs the equilibrium and produces a *deep outflow*, which in its turn lowers the level.—The same may be assumed to be the case in the Strait of Babelmandeb.

IX.—A Vertical Circulation is maintained in the Baltic Sound by an *excess in the influx of fresh water* into the Baltic; which at the same time *raises its level* and *diminishes its density*, so as to produce a *surface outflow*, leaving the Baltic column the lighter of the two, so that a *deep inflow* must take place to restore the equilibrium.—The same may be assumed to be the case in the Bosphorus and Dardanelles.

X.—A Vertical Circulation must, on the same principles, be maintained between Polar and Equatorial waters by the difference of their Temperatures: the level of Polar water being reduced, and its density increased, by the surface-*cold* to which it is subjected, whilst a downward motion is also imparted to each stratum successively exposed to it; and the level of Equatorial water being raised, and its density diminished, by the surface-*heat* to which it is exposed. (The first of these agencies is by far the more effective, since it extends to the *whole depth* of the water, whilst the second only affects, in any considerable degree, the *superficial stratum*.) Thus a movement will be imparted to the upper stratum of Oceanic water from the Equator towards the Poles, whilst a movement will be imparted to the deeper stratum from the Poles towards the Equator.

XI.—Of such a *Vertical Circulation* in the general body of Oceanic water we have evidence, on the one hand, in the *northerly* movement of the upper stratum, *of several hundred fathoms' depth*,

which carries the temperature of a warmer region into the Arctic circle (§ 33); whilst, conversely, there is now a large body of evidence as to the *general prevalence*, over the deep-sea bottom, of *a temperature not many degrees above the freezing-point of fresh water*, which cannot be accounted for in any other way than by an under-flow of Polar water towards the Equator. Further, under particular circumstances, a yet greater degree of cold is brought by Glacial currents into the Temperate zone (§ 36): thus giving distinct indication of a general movement of deep water from the Poles towards the Equator.

XII.—Lastly, it follows, if the foregoing doctrine be correct, that the General *vertical* Oceanic Circulation is the great agent in moderating the extreme cold of the Arctic basin; the water which flows towards it being not so much propelled into it by the Gulf Stream, as drawn into it from an area of which the ordinary temperature is little, if at all, above the normal. On the other hand, the Gulf Stream forms part of a *horizontal* or *superficial* circulation in the North Atlantic, of which the Trade Wind constitutes the *primum mobile:* a large part of its flow returns directly backwards into the Equatorial current, thus completing the *shorter* circulation; whilst the portion which passes northwards ultimately returns in the *superficial Polar currents* with which it interdigitates, —one of these currents being sufficiently powerful to maintain a distinct course back to the exit of the Gulf Stream, where its deeper portion not improbably re-enters the Gulf of Mexico as a reverse under-current through the Narrows.

CONCLUSION.

No one can be more sensible than I am myself that the General Doctrine propounded in this Paper cannot claim to be accepted as an established truth, until it shall have been tested by a vast number of observations, carefully carried out in various parts of the globe. But, if it should be thus substantiated, it will afford a more scientific basis for the study of Ocean-Currents than has yet been laid, and will thus tend to the improvement of Hydrography and Navigation. It may be hoped, therefore, that the systematic prosecution of observations upon the Temperature and Movement of the different strata of the ocean may henceforth be considered as a part of the regular duty of the British Navy,—the world-wide distribution of which gives to this country special facilities for cultivating this branch of inquiry, whilst laying upon it the special obligation of using those facilities in the interest of all nations.

Supplemental Note.—In an Address delivered before the St. Louis (U. S.) Historical Society on the 10th December, 1868, upon the "Thermometric Gateways to the Pole," Captain Silas Bent not only attributes the mild winters of Marseilles, Genoa, and Naples to the heating influence of the Gulf Stream, "which, as a surface-current, flows constantly into the Mediterranean through the Strait of Gibraltar," but goes on to make the following curious assertion:—"Pursuing these reflections, this matter presents a phase of international importance which, were it not for the inhumanity of possessing such a power, might place the whole of Europe at the mercy of this country. For, admitting that Europe derives its mild climate from the Gulf Stream, which no one now, I believe, disputes, then to divert this stream from its present direction, would be to bring the whole of Europe at once, so to speak, to its normal climatic condition: that is, France and Austria would have the climate of Canada; and England, Germany, and Northern Europe would become a frozen wilderness, such as British America and Labrador. To accomplish this, the possession of the Isthmus of Panama, and the expenditure of two or three hundred millions of dollars in the excavation of a sufficient width and depth of the rock only, that intervenes between the Carribean Sea and the Pacific, and the opening of a small sluice through the soil, to afford a beginning for the passage of the water from ocean to ocean—and but a short time would probably elapse before the channel would be large enough to give a new outlet to the equatorial waters of the Atlantic, and thus cut off that excess which now goes to make the Gulf Stream." Now that the temperature of the Mediterranean owes nothing whatever to heat carried into it by the Gulf Stream, may be considered as demonstrated by the fact that in summer the surface-current in the Strait of Gibraltar is *decidedly colder* than the surface-water of the Mediterranean; and that in winter it is *not at all warmer*. Further, if the doctrine above advocated be correct, the complete diversion of the Gulf Stream would produce very little deterioration in the climate of North-Western Europe, the amelioration of which is mainly dependent upon the general Oceanic circulation. In threatening us with the reduction of our winter temperature to that of Labrador, Captain Bent has quite lost sight of the consideration stated at the end of par. 30.

Mr. A. G. FINDLAY said, about eighteen years ago ('Journal of the Royal Geographical Society,' 1853, pp. 217-242), he had endeavoured to demonstrate before the Geographical Society—a little more clearly than had been done previously—that, in each ocean, currents revolved around a central area, the

Gulf Stream being the most remarkable of such currents, and that the general cause of all *surface*-currents could be attributed to the action of the prevalent winds. There is a Gulf Stream in every ocean; though, from the configuration of the land, and other causes, these great streams may not be so manifest in other oceans as in the North Atlantic. When, by the direction of the United States Government ten or eleven years ago, the narrowest part of the Gulf Stream was examined, figures were obtained which shut out all idea of its ever reaching our shores as a heat-bearing current. In the narrowest part, certainly not more than from 250 to 300 cubic miles of water pass per diem. Six months afterwards that water reaches the banks of Newfoundland, and nine or twelve months afterwards the coast of England, by which time it is popularly supposed to cover an area of 1,500,000 square miles. The proportion of the water that passes through the Straits of Florida will not make a layer of water more than six inches thick per diem over such a space. Every one knows how soon a cup of tea cools, and yet it is commonly imagined that a film of only a few inches in depth, after the lapse of so long a time, has an effect upon our climate. There is no need for calculations; the thing is self-evident. Although there may be no difficulty in attributing most of the well-known surface-currents of the ocean to a specific cause, such as the action of wind, yet this can only refer to the upper strata, not more than one-tenth of the entire depth. Of the lower beds we are in almost total ignorance; and it is only of late that we have acquired some amount of exact knowledge, not sufficient, as he believed, to establish a theory of general circulation, and yet, such a theory would seem to be an absolute necessity. The ocean is like the atmosphere; every part of it is intermingled in the course of ages. This can be proved mechanically, chemically, and biologically. All over the globe a surface-action on the sea can be traced, and there must be compensation somewhere. Again, if observations for specific gravity are taken at a certain depth below the surface, beneath the action of the sun, the falling rain, and the freezing ice, a wonderful uniformity is found all over the world. It is impossible that this uniformity should exist unless there is circulation. Thirdly, animals without power of voluntary locomotion exist over large areas on the bed of the ocean, and if the waters do not move they would starve. With regard to the depth of the Ocean he would adduce the following considerations. After the earthquake at Simoda, in Japan, on December 23, 1854, the tidal gauge at San Francisco was oscillated in a most remarkable manner, and it was subsequently agreed that it must have been due to the earthquake travelling across the Pacific in eighteen hours. Mathematicians have calculated that the size of a wave regulates its velocity, and the size of this wave demonstrated that the depth of the Pacific Ocean was about 2400 fathoms; and that is the real depth, since discovered, of that ocean. If, then, a wave, moving on the surface, is regulated by the depth of the ocean, there must be some connection between the bottom and the surface. The very interesting question of the Gibraltar and Mediterranean currents has occupied attention for a long period; and 150 years ago the lower outward current was inferred to exist in the Strait; an old evidence of it is cited of a vessel fired into (in 1712) and sunk in the middle of the Strait of Tarifa, which came ashore at Tangier, to the westward. On another occasion, in the Straits of Gibraltar, a vessel sunk off Ceuta, and she turned up off Tarifa on the other side, so that she must have gone across the Straits in the teeth of the stream. This was evidence, certainly, of an outward current. The expedition under Dr. Carpenter had brought much light on these subjects, but he thought that there would be some difficulty in attributing these opposing currents in the Strait entirely to a want of statical equilibrium. Because the same cause acted in a reverse direction in the eastern Straits of the Mediterranean; here the lower salt water flowed eastwards, and the upper

and fresher water constantly flowed to the westward. The subject is now assuming new importance, and he hoped that Dr. Carpenter and his co-adjutors will be enabled to make still further experiments in the same direction.

Mr. F. GALTON said he should be glad of further evidence that the causes assigned by Dr. Carpenter were adequate to produce a current as powerful as that in the Straits of Gibraltar. In respect to the circulation undoubtedly caused by the difference in specific gravity of two adjacent columns of water, he could not but remark that, so far as that difference was created by unequal temperatures, the beautiful model exhibited in support of the theory, showed the resultant circulation to be exceedingly sluggish. This was the more striking, because the temperatures at the two ends of the model differsd extremely. Dr. Carpenter, however, in the earlier part of this memoir, had ascribed the Gibraltar current more especially, to the inflow of water from the Atlantic, to supply the lower level of the Mediterranean, caused by its more rapid evaporation. He did not think it likely that a current of some 60 miles in length running at 3 miles per hour could be principally maintained by those means, unless there should be a considerable difference of level between the two seas. He therefore asked Dr. Carpenter what the difference of level was at the two ends of the Straits of Gibraltar?

Mr. J. BALL said, no doubt the experiment had proved that, under certain conditions, an interchange will take place; but in the actual ocean a multitude of causes are at work, and it is by the combined, or contrasted action of these causes, that the phenomena occur. Sufficient stress had not been laid upon the vast amount of evaporation, and the consequent actual diminution of the height of the sea, in tropical regions. That diminution cannot be less than six feet per annum. The moisture carried northward and southward, and deposited in the rainy zone, is also a displacement of enormous bodies of water. These were causes of motion in addition to the mere difference of temperature. The North Atlantic circulation must be considered as very different from that of the other great oceans; for the North Atlantic is, in fact, a closed gulf, as it cannot be supposed that Behring's Strait exercises any material influence upon it. The subject was one of immense importance, and however valuable the contribution that Dr. Carpenter had made to it, all must reserve to themselves the right to admit any other explanation of the phenomena which may be given in future.

Admiral Sir EDWARD BELCHER said it was a curious fact known to nautical men, that for the last hundred years not twenty ships of the Navy of much draught of water have succeeded in beating round from Gibraltar westward within the line of this so-termed counter-current. Dr. Carpenter seemed to have lost sight of the fact that there is an ebb and flood tide at Gibraltar; and that the rise and fall is about 2 feet 6 inches. Probably the experiments he had made were not calculated exactly at high water. When Captain Smyth made his experiments there, he succeeded in obtaining results which showed that a counter-current did exist, but his instruments did not enable him properly to prove it. By being mixed with mud, of course the specific gravity of the water might be increased, and such a mixture may have something to do in producing the under-current. The heat of the Mediterranean surface is not sufficient to account for the immense evaporation. The greater part of the evaporation, he believed, takes place on the surface of the rocks which are exposed to the sun's rays. At Cape de Verd the current flows at the rate of 5 miles an hour; and on one occasion, in a perfect calm, he put thermometers over at 20 fathoms, 50 fathoms, 100 fathoms, and 500 fathoms, with a *baréca* and flag attached to each. At the end of one hour all the *baréca*s and the ship were in the same relative positions as when they were laid down, showing that down to 500 fathoms the current ran at the same velocity as at the surface.

Professor WILLIAMSON said it was quite in accordance with physical laws, that water which becomes heavier by concentration should flow in the opposite direction to a lighter current, but it was reserved for Dr. Carpenter's beautiful experiment to give a decisive proof of it.

Admiral OMMANNEY asked if Dr. Carpenter had ascertained whether or not it was true that *Mediterranean* water passes out by the coast of Spain, while *Atlantic* water flows in by the coast of Marocco? The current running in by the coast of Marocco is much more rapid than that running out by the coast of Spain. The influence of the inflowing stream is very soon lost after it passes Gibraltar. The water at Cadiz is influenced by the number of rivers from the surrounding country. When, on one occasion, he was lying in the Bay of Cadiz, his launch was blown out to sea, and some time afterwards it was picked up in the Straits.

Mr. LAUGHTON thought there were two or three facts connected with the experiment they had witnessed which militated strongly against its application to the circulation of the water of the ocean. The circulation in the trough was entirely in vertical planes, the cold water running along under the hot, without any approach on the top to a horizontal circulation. Under no circumstances would the cold water flow along one side of the trough and let the hot water flow along the other. The circulation in the ocean, however, is horizontal in many instances. In the North Atlantic the hot water runs up towards the north on the east side, but on the coast of Greenland, and down Baffin's Bay, a strong cold current flows, which falls into the warm stream at the Banks of Newfoundland, and so makes a complete horizontal circulation. The Gulf Stream runs towards the north, while the North African current flows towards the south; and the current on the east coast of Africa runs in an opposite direction to that on the coast of Australia. In all oceans, without exception, there is a horizontal circulation. He did not deny that there is also a vertical circulation, but he was of opinion that it is extremely slow,—so slow as to have no effect on what people interested in navigation understand as currents. It took the best part of an hour for the blue to get from one end of the trough to another, yet there can be no doubt that the differences of temperature were much more extreme than were ever found in nature.

Dr. CARPENTER, in reply to the various objections, said the rapidity of the current in the Straits of Gibraltar might be accounted for by the fact that water always ran more swiftly through a narrow throat than through a wide channel. No one could be more sensible than himself of the fact that he had merely broken the ground of a wide field of inquiry, and he was prepared to represent to the Admiralty that at least six months' work would be required thoroughly to examine the Gibraltar currents alone. No doubt it was the difference of the tides that caused the discrepancy between the two sets of observations. He had obtained very distinct evidence from the temperatures that the surface-current of Mediterranean water flows out along the coast of Spain, while the Atlantic water flows in along the coast of Marocco. Horizontal circulations, he believed, were due entirely to the prevalent winds, the trend of the land, and other causes acting only on the surface. In the experiment he had displayed to the meeting, the differences of temperature were not so great as those to be found in nature. Polar water was subject to an atmospheric temperature of 40° below zero, and could be cooled down to 27° without freezing; whilst the fresh water cooled by the ice in the trough could by no possibility have been less than 39°. The warmth of the solar heat, on the other hand, was greater than that of the warm end of the trough. At Aden, Mr. Latimer Clark blackened a thermometer and put it on a black surface, and on exposing it to the full rays of the sun it showed 215°. Of course, a part of the heat in the Mediterranean was continually passing off as vapour.

ADDITIONAL NOTICES.

(Printed by order of Council.)

1. *Letter from Sir S. Baker.*

"Towfikēeya, White Nile, Africa, Lat. N. 9° 26',
"My dear Sir Roderick, "15 June, 1870.

"I have established a station at this important point of the Shillook country, in which I shall pass the rainy season. I have erected galvanized-iron magazines, 200 feet in length by 20 in width, within which I have stored all provisions and materials, and my flotilla of 53 vessels lies moored along the wharf. The troops and Europeans are in fair health; they are housed comfortably for the wet season.

"Mr. Higginbotham (engineer in chief), after great exertion and untiring energy, succeeded in transporting the steamers and machinery across the Desert to Khartoum, with which he followed me up the White Nile. All branches of the expedition thus happily effected a junction, without the loss of either a European life or that of a horse, although many of the latter had been brought so great a distance from Cairo.

"Thus far all has been successful. We are in excellent health, and I am fortunate in the possession of such trustworthy aids as my nephew, Lieutenant J. A. Baker, R.N., and Mr. Higginbotham, to whom I am extremely indebted, as they relieve me from much toil and anxiety. The steamers and other vessels which failed in the passage of the cataracts between Cairo and Khartoum, will, I trust, join me here before November, as I purpose leaving this during the first week of that month with reinforcements for Gondokoro.

"The great difficulties experienced by Mr. Higginbotham in the passage of the Nubian Desert, with so large a caravan of upwards of 1800 camels laden with unmanageable loads of material, caused a delay which lost the favourable season for the White Nile voyage. The unfortunate festivities attendant upon the opening of the Suez Canal had also delayed my departure from Egypt, as no steamer was disengaged.

"The failure of the passage of the cataracts by the six steamers and large decked vessels from Cairo was a severe embarrassment; but the climax to the series of *contretemps* was the total want of preparation at Khartoum, where I had expected to have found an organized fleet upon my arrival from Egypt, according to my instructions, given some months beforehand.

"These delays are inseparable from African affairs. Thus, instead of starting from Khartoum in December, we left on 8th February.

"Previous to my departure from Khartoum I was assured that the Great White Nile '*had ceased to be a navigable river!*'

"If you refer to my work 'The Albert Nyanza,' you will remember my description of the dam formed by floating rafts of vegetation, which, by accumulation, had caused an obstruction in the river between the junction of the Bahr Gazelle and the Bahr Giraffe. It appears that since my passage of the river, in 1865, the dam has been entirely neglected by the authorities at Khartoum, and the river, thus left to its own vagaries, has exemplified the principle that has formed the weary wilderness of marsh and decomposing vegetation that marks the course of the White Nile.

"The vast masses of floating islands continually brought down by the

stream have now formed an addition to the dam, and have produced a new district of many miles extent, beneath which the river passes by a subterranean channel; thus the White Nile has literally been closed to navigation. The slave-traders, thus shut out from communication with their old field, had discovered a passage to Gondokoro through the Bahr Giraffe.

"In 'The Albert Nyanza' you will see that I declared the Bahr Giraffe to be merely a branch of the White Nile, quitting the main river in the Aliab country, and that it was not an independent stream like the Sobat, as laid down upon the former maps. This is proved to be correct.

"I left Khartoum with five guides, intending to adopt the new route *viâ* the Bahr Giraffe. On the 17th February we entered the mouth of that river in N. lat. 9° 26′.

"The water was 19 feet deep, and the current about 3½ miles per hour, with a breadth from bank to bank of about 60 yards. At that time the surface was about 5 feet below high-water mark.

"The mean course of the winding river was from the S.W. Four small granite hills formed unmistakable landmarks in the boundless flats within 15 miles of the junction.

"Fine forests bordered the river for about 30 miles, diversified by plains of extremely fertile soil; beyond this the wood was scarce, and the forests were at intervals of 70 or 80 miles. As we proceeded, the wood ceased altogether, and the steamers depended upon the supply of fuel which I had stored in vessels in tow.

"At a distance of about 180 miles from the junction the dry land disappeared, and we sailed through endless marsh, where the river narrowed to a width of about 40 yards. It was in a deep, narrow channel that we were nearly wrecked by a savage hippopotamus, who recklessly charged the boats, breaking three floats from the steamer's paddle, and then, striking my iron diahbeeah, he cut two clean holes through the bottom-plates with his sharp tusks, and we should have sunk in ten minutes, without the assistance of the steamer's crew and engineers.

"As we drew nearer south, the rapidity of the current diminished; the river narrowed to a width that would barely admit the passage of the steamers when rounding the sharp bends. By degrees the channel disappeared, and the flotilla became fixed in a boundless sea of high grass. This was in N. lat., by observation, 7° 47′ 46″, and, by dead reckoning, 272 miles from the junction of the river with the Nile.

"Our guides, nevertheless, declared that the White Nile could be reached by this route, should we cut a passage for the boats through the floating marsh- and swamp-grass. The task appeared hopeless, as no sign of open water could be distinguished from the mast-head, and the quality of the marsh-grass resembled sugar-cane in thickness and toughness; while the tangled confusion of decaying vegetation, for a depth of 5 or 6 feet, could only be compared to a mixture of fishing-nets, ropes, mud, sailors' swabs, sponges, and canes, all compressed together in a firm mass, beneath which the water was from 10 to 12 feet deep, while grass about 9 feet high covered the surface to all points of the horizon.

"With about a thousand men we worked for thirty-two days, and cut about 8 miles of canal, through which, by dismounting the paddles, we warped the steamers; and with immense labour we succeeded in pushing the flotilla through a chain of small lakes, separated from each other by intervals of marsh. These lakes we discovered from time to time, as the canal progressed; and the intervening marshes between them formed the total of 8 miles' cutting, which enabled us to traverse a distance of 30 miles. The sight of open water, from time to time, was cheering to the men, fatigued and sickened by hopeless labour in mud and stench. We, at length, reached the

unmistakable open river: dry land appeared on either bank, and forests within two miles. Herds of antelopes and buffaloes were on the plains, and the rifles secured a supply of meat, which was much needed. The whole force rejoiced in the prospect of quickly reaching the Great White Nile, and the flotilla of thirty-four vessels sailed merrily on. Suddenly the steamers grounded, and one by one the other vessels followed their example. There was no depth of water!

"My diahbeeah, being of iron, had a light draught, and I pushed on in advance for about 3 miles, carefully sounding the channel. The general depth was only 3 feet; the steamers and heavier vessels required 4 feet 6 inches. At length, the light diahbeeah grounded in water only 2 feet 6 inches in depth. Quitting the vessel, and accompanied by my nephew, Lieut. J. Baker, R.N., I proceeded in a small rowing-boat, hoping that we might find deep water before us. We were quickly beaten, as the channel divided into three branches, and once more flowed through vast marshes. There was not sufficient water for the rowing-boat, and she grounded upon a bed of sand. The river was impassable.

"On the following morning I attempted a survey of each channel, but all were alike impassable; the painful fact was established that the route by the Bahr Giraffe is only practicable during the season of flood.

"The rainy season was close at hand. Already we had suffered from several storms, provisions were damaged, 160 men laid down with marsh-fever, some lives had been lost, and I daily expected the arrival of Mr. Higginbotham and party from Khartoum, who, with a small force, would have been helpless in the ever-closing marshes. These floating masses in many instances closed the newly-made channel a few minutes after the passage of the vessels; thus a weak force might be hemmed in, like a ship by ice-floes in the Arctic seas.

"I had beforehand determined that, in the event of an insurmountable obstruction, I would form a station at a convenient point upon the White Nile, at which I could unite all branches of the expedition, and prepare for the favourable season in November.

"I therefore quickly retraced our steps, cutting through those portions of the canal which had closed, and remounting the paddles of the steamers, we ran down the Bahr Giraffe at 10 miles an hour in advance of the flotilla, and took up a position for wood-cutting in a forest on the Nile banks, within 6 miles of the Bahr Giraffe junction. At this spot we were joined by Mr. Higginbotham and troops from Khartoum, together with the sections of steamers and machinery which he had so ably conducted through the desert journey from Cairo. Dr. Gedge and the six English engineers and mechanics were also with him in good health and spirits.

"My exploration of the Bahr Giraffe had saved them much difficulty; but this was not the only good result of my return.

"The Turkish governor of a settlement on the Lower White Nile (Fashōda), thinking all chance of detection impossible, had made a razzia on this portion of the Shillook country, and was kidnapping slaves and cattle, under the pretence of collecting taxes.

"Having received this information from the people, I came suddenly upon him with two steamers, and caught him in the act, with 155 slaves (women and children), 71 of whom were crammed within one small vessel. He was accompanied by about 350 soldiers, exclusive of a few irregular cavalry, with which force he was harrying the country. I insisted upon the immediate liberation of the slaves, and as the poor people were within sight of their villages, which had been so recently pillaged, I had the satisfaction of returning them to their homes, to their great astonishment and to the confusion of the slave-hunting governor.

"I then made an excursion to seek for a favourable locality for a permanent

station, and succeeded in discovering the spot from which I write—a convenient position on the east bank of the White Nile, opposite the Shillook country, with which tribe I have established the most friendly relations.

"The Egyptian Government established a station six years ago within the Shillook country, for the purpose of suppressing the slave-trade. This station (Fashōda) is in N. lat. 9° 54′ 25″, by observation taken during this journey. No improvement has been effected by the representation of the Government, but the entire country is a scene of anarchy and confusion, the governor setting the example of pillage. There can be no doubt that the Shillook, with good government, would become a valuable portion of the Egyptian territory. The soil is most productive; the population is estimated at a million, and the natural production of the country is cotton. Rice and several species of vegetables grow wild, including the grape-vine and asparagus. The country abounds with forests of fine timber, and the river is without obstruction direct to Khartoum.

"At present there is no trade, as the natives have no encouragement from the authorities; but with fair dealing and security of life and property, the entire Shillook country would become an extensive cotton-field. Although generally naked, the natives demand cotton-cloths, which they receive with eagerness in barter for supplies. They have already commenced an exchange of raw cotton for manufactured goods; but the quality of their cotton being inferior, from the absence of cultivation, it would hardly bear the cost of transport. I shall introduce, during this rainy season, the cotton-seed that I brought from lower Egypt; this I shall give to the chiefs, who well understand the advantage of an exchange of their natural productions for manufactures. The people are naked from necessity, and not from choice.

"As the camp is now completed, I shall turn all hands to cultivation. I have now 1500 men, who will be employed in agriculture, to produce during the rains the supplies of corn that will be required for the advance in November next.

"The advantage of this settlement was proved shortly after our arrival, by the capture of a slave-vessel that attempted to pass the station. Upon this boat I found 150 slaves packed like sardines, and concealed beneath the fore and aft decks. The slaves were liberated, their names registered, and each individual was given a ticket of freedom. The commanders I have placed in irons. One of the first works of my English blacksmiths was to cut through the chains that secured the unfortunate children; thus I have already had the satisfaction of liberating 305 of these miserable creatures, mostly women, young girls, and boys. I have no doubt that his Highness the Viceroy will appoint some trustworthy person to command this station after my departure.

"I have received valuable information from the Shillook chiefs concerning a new channel that the river has formed, connecting the upper and lower portions in the region of the dam. They declare this to be navigable, and they have offered their services as guides. I intend to make an exploration, with their assistance, when I shall have completed my arrangements in this station. I shall take two steamers and two diahbeeahs in tow, with fifty or sixty men. Should this good news prove to be correct, there will be no difficulty in November next, as I shall return here with an accurate knowledge of the passage. Should there be no navigable passage, I shall cut through the great dam, and open a permanent channel with a force of 2000 men.

"I am thankful that both Lady Baker and myself have been free from all ailments. My six English mechanics are industrious and well conducted, and are good representatives of the working-classes of England, in a difficult and trying enterprise, where patience and stability of character are necessary

elements. The Egyptian troops are orderly and resigned; the black soldiers are full of vigour, and suit the climate without troubling the doctors.

"I regret, my dear Sir Roderick, that I cannot yet give you much geographical information; but this expedition is not one of simple exploration. There is a grave responsibility with so large a force in Central Africa, far distant from supplies; and much caution is required in the advance. Pray God that we may meet again, my dear friend. With much love from Lady Baker and myself,

"Ever affectionately,
"Samuel W. Baker."

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2. *Letter from* Mr. John Ross, *concerning the Country North-west of Cooper's Creek, Australia.*

The following letter was communicated to the Society by T. Elder, Esq., who states that it was written to his agent, Mr. Waite, of Adelaide. The Umberatana sheep-station, from which Mr. Ross writes, lies 450 miles north of Adelaide; and Mr. Waite remarks, that if Mr. Ross's statement be confirmed, to the effect that there are 300 miles of river and lake in that region available for steam-navigation, it would become a grand country, when a railway is made from Port Augusta northwards, or when the projected Government telegraph is laid across the continent to Port Darwin. Mr. Ross had offered to take 10,000 or 15,000 sheep across to the northern shores of Australia. Mr. Waite concludes by saying that, from his knowledge of Mr. Ross, reliance might be placed on every word he says.

"Umberatana, 26th February, 1870.

"Some few days before I left our head-quarters on the Trucur for here, the camp was visited by a tribe of natives, numbering fifty-three, all men. They were introduced to us by a few of our regular native camp-attendants, who explained to us that the strangers were come from a long way to see white fellows, as they had never seen any before. After they had gratified their curiosity, they retired to their camps in a very orderly manner, for the night. Next morning they saluted us in a very friendly manner, and wished us goodbye. They were as fine a race of men as any I had ever seen, equal in stature and condition to the natives of the Murray and Lake Albert, as they were in 1839. After the strange natives disappeared, our camp-attendants told me the strangers wished me to go to their country with sheep, as they had plenty of grass and water; and other natives, beyond their country, informed them of plenty of white fellows living close to 'Big Salt Water.' They had sheep and horses, and it was their intention to go and see them in a little while after they got back to their own country. The white men, with sheep and horses, living close to the salt water alluded to, must be either Queensland settlers on the shores of the Gulf of Carpentaria, or the people of the Northern Territory. Whichever it may be, it is interesting to have such information from natives of the north-west interior, and leads us to anticipate something in its future.

"The country, from personal observation as far as Lat. 24° 30′ and in Long. 137°, is one continued scene of mountain, hill, and plain, with permanent water-courses in all directions, and of various magnitude; many of the hills grassed to their summits, mixed with a fine description of porcupine-grass. The plains are as solid in character, and equally, if not more luxuriantly grassed than the Gawler Plains in their most palmy days. I may have seen the country to advantage, but am inclined to think, from the character of the climate and its general features, that it permanently maintains its present state for grass and

water. My having seen the country previous to the rains experienced all over the north-west, together with the heavy dews which fall every morning, strengthens the opinion. The native 'Sambo,' whom I have with me, pointed out in various directions where powerful springs were situated, and the appearance of the surrounding country justified me in accepting the fact—the numerous water-courses flowing south to the Trucur and easterly to the 'Waite' having their origin from those springs and the high mountains visible as far as the eye could penetrate—mountain after mountain, with towering peaks equal, if not exceeding, in elevation the highest of the Wellpuna groups. I only wish I had been supplied with a few more days' food; but had nothing, and was obliged to return. The native and myself could have managed, but I had one of our men with me, and the thoughts of a few days without food would have been considered rash and careless of safety. I have seen, however, sufficient extent of country, grassed and watered, for the support of over a million of sheep. The fact of the country not having been examined or seen till now is to be accounted for by the circumstance that Stuart, on his way to the north coast, passed to the westward, and on his course described only a few of the most prominent hills seen, which may probably be the western termination of the mountains I describe, lying about 160 miles to the eastward of Stuart's track. Sturt's expedition was too far to the eastward. He saw, I think, no hills over 1000 feet in height after passing 'Mount Pool,' one of the Eastern Barnor Range. That any of the people in the north-west have never seen the country is not to be wondered at. Having sufficient country for their wants, they have never been compelled from necessity; and a trip through the further interior to gratify curosity, or add to a knowledge of it, perhaps never occurred to them. About 75 miles up the Trucur from our camp, timber of good quality and different kinds appears plentiful—the white gum-tree seeming the most conspicuous. Every water-course, large and small, is well timbered along its banks and flats. Our sheep country is also well-stocked with timber of a stunted kind, which affords excellent shelter for sheep or cattle—they having their grass, water, and shelter wherever they go.

"With such a body of sheep in a strange country, one could not but feel a little anxious for their safety; such being the case, it is necessary to know what we have to fall back upon in case of unforeseen necessity. Feeling my position, I determined on seeing the country all around our station; and having done so, I am able to assure you that, although seasons of unknown scarcity and want may succeed one another, resulting in casualties never before heard of, our own station will be safe. Bringing the sheep back for shearing by the nearest and best route is now occupying my attention; going back the way we came is open to us, but we fear, when we require to travel, the whole country will be eaten off with sheep. The Beresford, Mr. Hamilton Stewart's creek, is now looking very bad; in fact, all on this side of Strangway's springs is anything but cheering. We may get on well enough to the Finniss, but from thence downwards is miserable, and very short of water. We can leave the north-west road at the Welcome, and make for the Clayton, which is our only chance with fat sheep; and for shearing—to avoid bringing down the sheep by the north-west road, I thought—and still do think—in case of necessity, I can make back by the north and east shore of Lake Eyre, crossing the Jarvis or Cooper as near the lake as possible. This will shorten the distance at least 100 miles, and no one to press us forward. With this in view, I started to examine how far it was practicable. I followed the north bank of the Trucur in its easterly course, in order that I might cut any stream entering from the northwards, having an eye also to the state of the country for grass and water. At 25 miles below our camp is the junction of the Trew with the Trucur, both rivers running strong, and grass everywhere up to the horse's middle. 15 miles below is the

junction of another creek, and flowing from south-west, and 10 miles is another creek from the same direction as the last; the main stream now assuming the character of a fine large running river, with country on both sides well grassed as far as could be seen. 15 miles below the junction of the last stream, the country was rapidly changing its character, but passable for travelling sheep. The Trucur here, to my astonishment, disappeared; instead of a fine running river, I was following the shores of the long and endless dry basin of a salt lake, with only water here and there. To make sure I had not lost the Trucur, and to ascertain its course, I returned to its bank and followed it to its entrance into the lake, but could not see anything like an outlet. This part of the lake had water and was perfectly fresh; but, knowing the rivers had been running for over a month, I judged there should be more water in the lake, and that the river must have an outlet not far off, but I could not cross the Trucur to the south bank. To ascertain the fact was impossible; the river was too deep and the banks steep and boggy, and my only alternative was to follow the lake till I could swim or cross it somewhere; but I could find no place where I could do so, and had to undertake the very weary task of following its shore till I found its outlet somewhere—a salt-basin exactly similar to the Coorong, but without so much water. The country, however, was improving fast. I headed the lake about 30 miles from where the Trucur entered, and found the outlet without any water; followed the outlet for 10 miles, and here joined a fine stream of fresh water, flowing from due north—water as clear as crystal. This was the Waite River, which I expected to have met with early the day before. When out with 'Sambo' and Long, we crossed a large branch of the Waite, 150 miles E. of N. from our camp on the Trucur, and the black told me it went a long way, and joined 'Another Old Man Creek.' I followed the Waite downwards for 6 miles till it emptied into a fine large lake, apparently deep and full, the water perfectly fresh; the lake about five miles long and two wide. Natives were here seen by hundreds, some running in all directions from us, and all endeavouring to gain the opposite side of the lake. My only companion was so ill he could not sit his horse, and told me he feared he should not live to get back to camp. I, however, did not put myself in contact with the natives, and none of them would come near us. I followed the lake to the outlet of the Waite, when I traced the river downwards for 12 miles, keeping the south bank; here it forms a junction with the Jarvis River, about 80 miles from Lake Eyre. The Jarvis (or Warburton's 'Cooper Creek,' and Sturt's 'Eyre Creek') was flooded, running strong, the fresh water a little coloured, and about 30 yards wide; banks very steep and well timbered, having a course from north-east to south-west. Country about as good as on the Waite, and the lake, as far as seen, promising well for cattle. Natives very numerous in all directions, and all cannibals, judging from all the wherlies I examined, as I found human bones well picked in all of them; the bones showing the victims to be of various stages of life. Whether their end was by violence or not I could not determine, but fancy they inter nothing, but eat all—human bones and large fish-bones are to be seen in all native camps. The banks of the Jarvis were so steep and boggy, we found it impossible to water our horses, and had to trust to rain-water; and apparently very little rain fell on a great extent of this country—water for ourselves and horses was by no means plentiful. Our tea was thick and filthy, and made my sick man worse; boiled 'munneroo,' three times a day; it was all he could take, and I think helped to keep him alive, though it did not cure him. I got him home, but not without some anxiety and care for his safety. Followed the Jarvis downwards, keeping the north bank for 20 miles; water here a little brackish, deep, and about 60 yards wide. 15 miles further the water was not drinkable, but the river assumed a more formidable appearance, about

80 yards wide, banks still very steep, and the flats thickly timbered and of stunted quality. At 30 miles lower I came in contact with the missing Trucur, but not unexpectedly, as I made certain, from its course, it would form a junction with the Jarvis, or go direct to Lake Eyre. The former is now an ascertained fact; showing the only map I had to be at fault, which represents the Trucur having a south-east course, emptying into Lake Eyre. The Trucur and other streams are not marked out. The country generally about the Jarvis is very poor—white sand-hills, with stunted vegetation; a very poor country for stock of any kind. The Trucur here was running strong, slightly brackish, deep, and about 30 yards wide, even banks, and looked exactly like an English canal. I tried to gain the opposite bank, and make the north shore of Lake Eyre; but it was impossible, from the boggy nature of the banks—our horses would not face it. I then shaped my course for home, pretty well disgusted at not being able to sight Lake Eyre. The Jarvis River, where I left it, was quite 100 yards wide, and I should say very deep, and salt as the ocean; the lake I judged to be not more than 15 miles off. I gained the summit of the highest sand-hill I could see, with a view to sighting the lake, and succeeded. My position from the nearest shore of the lake being 15° East of North, and distant about 10 miles, the Jarvis River visible nearly from the junction of the Trucur, winding its way wide and deep into the lake, and I could distinguish, far into the lake, the outlines of a deep channel of water. I am strongly impressed with the belief that the Jarvis would be navigable for steamers, such as those on the Darling, for upwards of 100 miles from the lake. Where the lake is properly examined, I believe deep water will be found in all seasons, extending to the Priscilla Springs or the Finniss, giving a probable inland navigation of over 300 miles, such as very few of the present day even dream of. Vexed at not being able to cross the Jarvis, and march to the Clayton—also cut out from the lake by the Trucur—I returned home, resolved to try again, if time and opportunity would permit. On my homeward course I came in contact with the second branch of the Trucur, and the one followed on my outward course; resolved at once on crossing, but nearly lost one of my horses in the attempt, and had to make a *détour* of 30 miles to gain the north bank—my out-track, which is good travelling country. I might have crossed the Jarvis, had I followed the river upwards, no doubt; but thought at the time there would be no distance saved in bringing the sheep so far to the north-east. I have since considered there would be great advantage in bringing back the sheep by a road where no one could insist on our pushing forwards. I have splendid country on both banks of the Trucur, and for 30 miles below our lowest sheep-camp at the junction of the Fum. Up the Trucur from our main camp, for 150 miles, every inch is splendid pastoral country, and no knowing how much further the good country extends; probably to the north shore. The Waite River I had no opportunity of examining, but, judging from the one branch I had seen, north-easterly from the Trucur camp, it waters a good country. Sambo, the native, termed it *an old man creek*, and that it had three lakes in its course, and water never fails in them. I fancy one of the lakes spoken of by Sambo must be that seen 12 miles from the Jarvis River, and in very good cattle country. I say nothing of the numerous branches and tributaries of the Trucur, all watered, and more or less permanent, and all well-grown country. The Fum, Neils, Natuna, and Brown's Creek, I care nothing about; the country about them is not of a lasting character, although watered to any extent.

"As I have given you so much information about the north-west, I will now presume to go further, and say the missionaries stationed at Coppermanna should remove to the Trucur, where their labours amongst the natives would be of greater advantage. They are doing no good where they are, and court the Government police protection for them alone. Lake Hope has been dry for

years, and the country abandoned by stock: the natives whom the missionaries attempt to instruct and civilize are in a desert country, that can never be available for stock of any kind. At the Trucur there are a hundred natives to one in the Blimman district, and they are a fine intelligent race of people. The missionaries stationed at the Trucur would answer two purposes—the instruction of the natives, and, being situated in the direct route for the northern territory, serving to assist our own Government. The Coppermanna police, 150 miles further on, and two more police-stations, at equal distances apart, would at once open up direct communication between our Government and the people of the northern territory, and encourage the occupation of thousands of square miles of good country now lying idle.

"JOHN ROSS.

"*Peter Waite, Esq.*"

PROCEEDINGS

OF

THE ROYAL GEOGRAPHICAL SOCIETY

[Issued July 12th, 1871.]

SESSION 1870-71.

Fifth Meeting, 23*rd January*, 1871.

Major-General Sir HENRY C. RAWLINSON, K.C.B., Vice-President, in the Chair.

Presentations.—*Captain Llewellyn W. Longstaff; John D. Allcroft, Esq.*

Elections.—*Sir Cecil Beadon*, K.C.S.I. (late Governor of Bengal); *John Cleghorn, Esq.; James Dentry, Esq.; Edward Fane, Esq.; M. Gray, Esq.; J. E. Green, Esq.; Captain Robert Hall*, R.N., C.B.; *Henry H. Kennedy, Esq.; George Kenrick, Esq.; G. A. Rooks, Esq.; W. E. Stark, Esq.; R. Stein, Esq.; G. B. C. Yarborough, Esq.* (Lieut. 14th Hussars).

Accessions to the Library from January 9th to 23rd, 1871.—'Natural History of the Azores.' By F. Du Cane Godman. 1870. Purchased. 'Die Sprache der Nama.' Von Dr. Theophilus Hahn. Leipzig, 1870. Donor the author. 'Travels in India in 1780-83.' By W. Hodges. 4to. 1793. Purchased. 'The Tehuantepec Rail way.' New York, 1869. 'The Diamond and Gold Fields of South Africa.' A Map. By J. Wyld. 1871. Donor the Publisher. 'Dove's Law of Storms.' Translated by R. H. Scott. 1862. Purchased. 'Some Account of the City of Dacca.' Proof Plates. Folio. 1823, 25. Purchased. 'Tour through Northern Europe.' By J. G. Seume. 1807. Purchased. 'Trade through Burma to China.' By Major E. B. Sladen. Glasgow, 1870. Donor the author. 'The Traveller's Guide to Madeira, 1814.' Purchased. 'Physical Geography in its relation to the prevailing Winds and Currents.' By John Knox Laughton. 1870. Donor the author.

Accessions to the Map-room since the last Meeting of January 9th, 1871.—Four Maps of Dr. Petermann's 'Mittheilungen' for

January, 1871, viz.:—No. 1. Paris und Umgebung. Bearb. von C. Vogel. No. 2. Frankreich, in seiner Politischen gestaltung zu Anfang Dezember, 1870. Von Hrm. Berghaus. No. 3. Geognostische Karte des Alleghany-Systems. Von Hermann Credner. No. 4. Geognostische Profile in Alleghany-Systems. Von Hermann Credner. Presented by Dr. Petermann. Johnston's War Register, No. 10. Presented by A. K. Johnston, Jun. A Map of South-East Africa, showing the Diamond and Gold Fields. By J. Wyld, F.R.G.S. Presented by the author. Admiralty Charts, 39 sheets, bringing this series up to January 14th, 1871. By the Hydrographic Department, through Admiral G. H. Richards.

The following Paper was read:—

Resumé of the recent German Expedition, from the Reports of Captain Koldewey and Dr. Laube. By Captain Sir LEOPOLD M'CLINTOCK, R.N.

BEFORE entering upon the accounts of this expedition, it may be useful to state that the *Germania* was a screw-steamer of 143 tons and 30-horse-power, with a complement of seventeen officers and men, and that she started, in company with the *Hansa*, a sailing-vessel of 242 tons, with a crew of fourteen souls. Both vessels were supplied with two years' provisions and stores; but the *Hansa* was chiefly laden with fuel intended for the future supply of the *Germania*.

The main object of the expedition was geographical discovery. Captain Koldewey was directed, in the first instance, to make for the Pendulum Islands on the east coast of Greenland, and from thence to trace the northern continuation of that great continent as far as possible; if compelled to winter there, he was directed to travel by means of sledges onward towards the North Pole. Thus far, the instructions given to Captain Koldewey were sufficiently explicit; but Dr. Augustus Petermann, of Gotha, by whom they were drawn up, entertained hopes of far more extensive geographical discovery, as is apparent from these voluminous instructions, which contemplated Captain Koldewey's penetrating "the belt or girdle of ice which encircles the North Pole, and has hitherto barred all access to the Polar Sea." They desire him, should he reach the Pole, to winter there if possible, or, failing in this direction, they require him, should he reach Behring Strait, to proceed onward to the exploration of the Siberian Islands.

It was on the 15th of June, 1869, that those two vessels, being honoured by the presence of His Majesty the King of Prussia, sailed from Bremen on their lonely voyage.

Exactly one month later, when in lat. 74° 49′ N. and long. 10° 50′ W., they first met with polar ice. Fogs were now frequent, and the *Hansa* was lost sight of for a few days. On the 20th of July, in 75° N., the ships again separated, and this time finally.

Captain Koldewey found it impossible to penetrate the heavy pack-ice, until he sailed southward to 74°, where, on 1st August, it was sufficiently loose to steam through; and although also impeded by fogs and calms, he made such occasional progress, that on the 5th August the *Germania* reached Sabine Island, in 74½° N. and 19° W., and anchored at its southern side. It may be useful here to state, that this island and the adjacent coast of Greenland were discovered by Captain Clavering, of H.M.S. *Griper*, in 1823; and that Captain—now General Sir Edward Sabine, the distinguished President of the Royal Society—who accompanied Clavering, made a series of very interesting observations for the purpose of determining the magnetism and compression of the earth, upon the island which bears his name.

On 10th August the *Germania* again pressed northward, keeping along the Greenland shore; when in 75° 31′ N. her progress was stopped by closely-packed ice, which pressed in against the land-ice. This land-ice extended unbroken from the coast of the mainland out to Shannon Island, a distance of 14 miles: it was of a very formidable description, margined in some places with a fringe of crushed-up floe-pieces, forming hummocks 40 feet high.

The *Germania* remained in this position for several days. As there was nothing but ice visible to the northward, and there appeared no prospect of any further progress in that direction, Captain Koldewey moved his ship to the south side of Shannon Island on the 16th August, and anchored her close to Cape Philip Broke.

Here the first exploit of the voyagers was the shooting of a musk-ox. Although there was but very little vegetation upon the island, yet small herds of these animals were seen upon it.

Eleven days were spent in the scientific examination of Shannon Island, during which time a constant watch was kept from a mountain-top upon the ice to the northward. But as it continued unmoved, and the close of the navigable season was at hand, Captain Koldewey returned southward, and anchored his ship on the south side of the lesser Pendulum Island on the 27th August.

Even at this early date the young ice was so strong that it was necessary for the *Germania* to charge it at full speed, in order to force her way through it.

Here, as at Shannon Island, scientific observations fully occupied Captain Koldewey and his companions, until it became necessary

to place the *Germania* in safety for the approaching winter. Therefore, on the 13th of September, she was moved into the same little harbour in which she had originally anchored on the 5th August, and which their subsequent experience proved to be the only safe one between the parallels of 74° and 77°.

Wintering preparations were now actively commenced; and on the 22nd September the ship was firmly frozen up.

The first of the autumn sledging-parties had been sent out on the 14th September, and remained absent for eight days; this party reached the mainland, and then travelled for four days up a newly discovered fiord, finding many petrifactions and much lignite; large herds of reindeer and musk-oxen were seen, and the vegetation—chiefly *Andromeda*—was rich, when compared with that on Sabine Island. Shooting parties were now organized, and with most satisfactory results, for many musk-oxen and reindeer were shot within the next few weeks of remaining daylight; but after the beginning of November, neither these animals, nor the bears which had been their constant neighbours hitherto, were any longer to be seen; a supply of fifteen hundred pounds of good beef and venison had, however, been most fortunately obtained.

In the latter end of October a second sledge-journey was undertaken, this time to the southward; it returned on the 4th of November, having discovered another fiord. On the day following, the 5th of November, the sun disappeared altogether, and the arctic night of ninety days' duration commenced.

At the close of the year, after much stormy weather, the temperature rose to 25° (Fahrenheit); but it soon fell again below zero; and early in January, 1870, the thermometer indicated a temperature of −40° Fahrenheit, which was the greatest degree of cold observed throughout the winter. Captain Koldewey speaks of the exceedingly furious northerly storms which prevailed throughout December. The most severe of these lasted from the 16th to the 20th of December; it broke up the ice outside the harbour, and even to within three hundred yards of the ship, but fortunately she had been placed in its most sheltered part, and close to the shore in only ten feet of water, otherwise she would have been drifted away amidst the crushed-up ice, to almost certain destruction.

Yet these brave and simple-hearted men were not cast down by the gloomy terrors of their situation, for Captain Koldewey thus describes their Christmas revels:—"They danced by starlight upon the ice; they celebrated Christmas Eve with open doors, the temperature being 25° Fahrenheit; they made a Christmas-tree with

evergreen *Andromeda*; they decorated the cabin with flags, and laid out upon their tables the presents prepared for this occasion by kindly hands; each received his share, and universal cheerfulness prevailed."

After this festive season they set themselves to prepare the equipments for their spring sledging-journeys; the most important of these journeys having for its object the attainment of the highest posible degree of north latitude.

In February the bears returned simultaneously with the sun; and the daily excursions upon the island, now taken by the scientific gentlemen of the expedition, were rendered dangerous by their boldness; and although every one was required to go armed, yet some accidents occurred: one of the savans was severely wounded in the head, and was dragged for more than four hundred paces, before he was rescued from the bear. After the lapse of a few weeks this gentleman recovered from his wounds.

On the 8th of March a party, consisting of twelve men, with two sledges, left the ship; but their equipment proving inefficient, and their sledges too heavily laden, they were compelled to return almost immediately, in order to remedy these defects.

Starting again on the 24th of March, they sledged northward until they attained the latitude of 77° 1′ on the 15th of April. But northerly storms presenting insuperable difficulties to their further progress, they were compelled to retrace their steps. The travellers were now so fortunate as to shoot some bears, whose blubber afforded a timely supply of fuel with which to warm their food, and, the northerly storms amply filling the sails hoisted upon the sledges, such rapid progress was made upon the return journey that, on the 27th April, they reached the ship, the whole party being greatly exhausted by their severe exposure and exertions.

At the extreme northern point reached by this party, *i.e.* 77° 1′, the belt of land-ice which margined the shore was four miles in width, and appeared to be several years old; in fact it seemed to the travellers like "a bulwark built for eternity;" whilst all to seaward was an unbroken expanse of very heavy hummocky ice.

Two other sledge-parties were despatched from the *Germania* early in May: one of these was employed in making geographical and scientific explorations of the adjacent coast of Greenland; the other party was directed to attempt the measurement of an arc of the meridian.

About this time the bears were particularly numerous and bold; it almost seemed as if they had combined to besiege the few who now remained on board the ship: the greatest caution was neces-

sary to prevent accidents, and although several of them were shot, yet it was impossible to frighten the rest away.

Thawing commenced about the middle of May; towards its latter end the sledge-parties had to wade through the water which flooded the surface of the sea-ice.

On the 29th May, Lieutenant Payer and his party returned on board with many geological specimens, fossil plants, &c.; and during the spring several short journeys were made in various directions for the purpose of collecting zoological and botanical specimens.

In the month of June there was much open water to the south-eastward, and large portions of land-ice were continually breaking off.

On the 10th of July the ice immediately about the ship began to break up, and by the 14th boating became practicable; therefore an expedition was made to the Esquimaux village on Clavering Island, which is marked on the charts. Ruined huts only were found, and these had long been abandoned, apparently very soon after Clavering's discovery of them; and, although traces of their former abodes were found wherever the Germans landed, yet no Esquimaux were seen by them.

On the 22nd of July, the *Germania* once more steamed northward, to renew the attempt of the preceding year. Her boiler-tubes now began to leak seriously, and it became evident that the boiler would soon fail altogether; after some delay it was temporarily patched up, and by following a narrow channel between the firm land-ice and the loose pack, she penetrated as far as the north-east cape of Shannon Island, in 75° 29′ of latitude. Beyond this position, unbroken ice barred all progress; and, hope being extinguished in a northerly direction, the *Germania* turned southward on 30th of July, and in that direction continued her interesting explorations. The "Mackenzie Inlet" of Clavering was found to have no existence: its place being occupied by a low flat plain, on which reindeer were numerous; and so unaccustomed were they to the sight of man, that five of them were very soon shot.

On 6th August, when in 73° 13′ N. a large fiord was discovered and entered by the *Germania;* it was perfectly free from floe-ice, but many large icebergs were drifting out of it. It was soon noticed that the further they penetrated into the fiord, the warmer became the temperature of the air and of the surface of the sea. There were many branches to this fiord, and the scenery is described as being grand—resembling the Alps. An unknown land—the real interior of Greenland—revealed itself before their astonished gaze, ever becoming more beautiful and imposing. Numerous glaciers,

waterfalls, and cascades came from the mountains, which rose higher and higher towards the west.

A mountain 7000 feet high was ascended, and even from this elevation no limit to the western or principal arm of the fiord could be perceived. Mountains, in about 32° W. longitude, were ascertained to be 14,000 feet high. The *Germania* ascended this fiord for 72 miles, reaching 26° W. longitude, when her boiler almost ceased to act; and, fearing the consequences should it fail altogether, Captain Koldewey commenced his homeward voyage on the 17th of August. He re-entered the packed ice at the mouth of the fiord, and was occupied until the 24th in forcing his way through it, only reaching the open iceless sea in 72° N. and 14° W.

The *Germania* was compelled to make the rest of her voyage under sail, as her boiler had become useless; she safely arrived at Bremen on the 11th September, with all well on board. With the exception of two accidental wounds, this remarkable voyage was performed without any kind of sickness on board,—a circumstance which reflects the highest credit upon all those whose duty it was to equip, provision, and conduct the expedition; the abundant supply of fresh meat, amounting in all to 5000 lbs., so fortunately obtained at their winter quarters, doubtless contributed largely to maintain the health of the crew.

Second only in importance to extensive geographical discovery, did the projectors of this expedition seem to value scientific research. The thirty-one individuals composing the entire Expedition, included six scientific gentlemen; and every spare moment appears to have been usefully employed by these talented observers, in whose hands the very best instruments had been placed.

The series of magnetic observations appears to have been very extensive and complete; their amply filled meteorological journal will also contain some very interesting and remarkable notices of the Aurora Borealis: the auroral rays, we are told, were generally found to converge towards a point near the zenith; its angle of elevation above the horizon being exactly equal to that of the magnetic inclination, and its azimuth equal to the magnetic declination. A complete series of observations on the specific gravity and temperature of the sea, at its surface and at various depths, was also taken—nor did the glaciers escape the intelligent scrutiny of these industrious savans; the daily movement of one of those examined in the fiord was above five inches. It is remarkable that whilst the glaciers upon the seacoast were but few in number and inconsiderable in size, those far up in the fiord were magnificent: the length of one of these was about 4½ English miles. In strict

accordance with Alpine experience, these Greenland glaciers were found to exhibit a very great decrease of magnitude.

This Greenland shore, under the 75th parallel of latitude, is not the icy desert which we have hitherto supposed it to be. Reindeer were abundant, as many as fifty having been seen at a time; musk-oxen were not rare,—they roamed about in small herds, sometimes numbering fifteen or sixteen; whilst smaller animals, including ermines and lemmings, were also met with. Birds were comparatively scarce; herds of walruses were often noticed, but no whales were seen.

Although the geographical discoveries of this voyage are not of very great extent, yet, as they relate to a region of which so little was previously known, they possess an unusual amount of interest for the geographer; and the vast number and variety of observations and specimens, so industriously collected, cannot fail to be regarded by men of science generally as possessing great value.

Hitherto the only trace of the musk-ox in Greenland has been limited to the finding of a few decayed skulls by Dr. Kane, on the shores of Smith Sound under the 79th parallel: it therefore seems fair to conjecture that these animals reached north-eastern Greenland by following the shore-line to the eastward, from the outlet of Smith Sound and Kennedy Channel, in 82° N.; and in this manner have rounded the northern extreme of the great central glacier of Greenland.

The absence of natives, and of all recent traces of them, is very remarkable. It will be remembered that, in 1829, Captain Graah found the southern Greenlanders inhabiting as far north as $64\frac{1}{4}°$; that they did not know of any human beings existing further to the north, nor was it possible for them to travel in that direction, all their attempts to do so having been foiled by enormous and impassable glaciers. Graah tells us that in this dreary southern region the only land animal known to the natives is the fox!

In 1822, Scoresby partially explored the coast of East Greenland between the parallels of 70° and $72\frac{1}{2}°$. He found many ruined habitations and graves, but no human beings nor recent trace of them.

In the following year, Clavering met with a party of twelve Esquimaux in 74° N.: but neither he nor Scoresby found reindeer or musk-oxen; and the fact of these animals being numerous and devoid of fear of man, in 1869, adds much force to the conjecture that but very few, if any, of this isolated tribe of Esquimaux any longer exist. Now, as the musk-oxen, and also the reindeer, appear to have wandered hither from the northward, and not from the southward, it seems most probable that the natives pursued

the same route also. If it be true that this migration of men and animals was effected from west to east along the northern shore of Greenland, we naturally assume that it does not extend far towards the Pole; that probably its most northern point is at the eastern outlet of Kennedy Channel, and that it turns from thence sharply towards the east and south-east—the distance in a straight line to the most northern point reached by Koldewey is not more than 600 miles. It is not less strange than sad, to find that a peaceable and once numerous tribe inhabiting a coastline of at least 7° of latitude in extent, has died out, or has almost died out—whilst at the same time we find, by the diminution of the glaciers and increase of animal life, that the terrible severity of the climate has undergone considerable modification. We feel this saddening interest with greater force when we reflect that the distance of Clavering's village from the coast of Scotland is under 1000 miles! They were our nearest neighbours of the new world.

We now return to the *Hansa*, which vessel became separated from the *Germania* on 20th July, 1869, when both ships were endeavouring to force through the loose pack-ice towards Sabine Island. The *Hansa* was driven far to the south by unfavourable winds and currents. Her commander, doubting the existence of any clear water along the Greenland coast, steered eastward out of the pack, and then to the north as far as 75°; here he tried to reach the coast, and was so far successful as to approach within 18 miles of it, and, about the 24th of August, to gain sight of the Pendulum Islands. No coast water could be seen; and whilst waiting for the further disruption of the ice, the ship became surrounded and beset amongst vast fields of it, on the 5th of September. They could see the open sea to the eastward of them, but could not reach it. By the middle of September they were firmly frozen up, and all prospect of escape from a winter in the ice had vanished.

They did not, however, allow the gloomy prospect to discourage them, but, putting the best face upon it, set to work and made their vessel as secure as they could, by docking her in an ice-floe, the superficial area of which was upwards of three square miles. The best possible arrangements appear to have been made for both safety and comfort that such circumstances would admit of. As a temporary refuge, in the event of the destruction of the ship, a hut was built upon the floe, of the bricks of patent fuel which the *Hansa* had on board as a supply for the *Germania*.

The wintering preparations were hardly completed, when fierce storms burst upon them. They drifted south-westward, gradually nearing the Greenland coast, until about the middle of October and

in lat. 71°, when they were close to it. On 18th October the ice was in fearful motion, although the weather was calm. On the 19th it blew a storm; their sheltering floe was broken, and the ship was nipped (or squeezed), but she rose to the pressure until lifted fourteen feet above the sea, when she was thrown on her broadside upon the ice.

When the storm ceased, the crushed-up ice, together with the ship, sank back into the water; but it was now discovered that she had sprung a fatal leak. Every effort was made to save provisions from the sinking vessel; yet, had not their provisions been previously, and as it is stated accidentally, removed to the deck, it is hardly possible that enough could have been saved to preserve the crew from starvation.

The *Hansa* sank beneath the ice on the 22nd October, in lat. 70° 50′ N. and 21° W. Dr. Laube writes:—"We made ourselves as snug as possible, and, once our little house was completely embanked with snow, we had not to complain of the cold. We enjoyed perfect health, and occupied the time with long walks and with our books, of which we had many. We made a Christmas-tree of birch-twigs, adorning it with pieces of wax taper, and rejoiced in your kind Christmas gifts, which we had saved from the ship.

"In the name of all our crew I return you most hearty thanks, and beg you to convey the same to your honoured wife. It seemed to us as if you had visited us on that Christmas eve, and you gave us one happy hour in the midst of our gloomy situation."

The greatest cold recorded was $-29\frac{1}{2}°$ Fahr., and it occurred in December. After Christmas they had frequent storms, and drifted close along the land amidst much ice-crushing; their floe was broken off all round them, insomuch that by the 4th January, 1870, it was reduced to one-eighth of its original size.

On 6th January, in lat. $66\frac{3}{4}°$, the sun reappeared.

On the night of the 15th January, the floe cracked asunder under their house! The crew now fled to their last retreat—their boats; in which they lay, unable to clear out the snow, and but partially sheltered from the raging storm.

On the 17th the weather improved; they recovered from beneath the snow enough of the ruin of their hut to build a new, but much smaller, one. It could only receive half of the crew, so the other half had to live in the boats.

February was calm and fine, but very cold; they continued to drift along the land.

On 20th March they were off Cape Mostling, and found themselves amongst icebergs; there was more ice-crushing, but their floe

was not any further reduced: its circumference, subsequent to the 15th January, remained at 360 paces.

From the end of March to 17th of April, they drifted between Skioldunge Island and Cape Moltke, alternately to the north-west and south-east; a storm then drove them far to the south. Early in May, they were in lat. 61° 12′. Hitherto, they had never been able to reach the land, but on 7th of May some lanes of water opened a way for them; so they launched their boats, with the intention of progressing southward alongshore. It was not, however, until 4th of June that they succeeded in reaching the Island of Illuidlek, in 60° 57′ N. They struggled onward continually, amidst ice and storms, and further checked by an incorrect chart, which led them into a deep fiord, instead of King Christian IV. Sound; and on 13th June they reached the Moravian missionary station of Friedrichstal, where these gallant men were most joyfully welcomed by their own countrymen, after their unparalleled sojourn of 200 days upon a drifting ice-field! They had not only experienced far more than the ordinary trials of an Arctic winter, but they had also suffered continually from hunger.

On the 21st June they reached Julianshaab, where they were received on board the Danish brig *Constance* for passage to Europe, and were landed at Copenhagen on the 1st September.

It is melancholy to record that one of this heroic little band of fourteen souls was bereft of reason by the terrible sufferings and horrors to which they had so long been exposed, and of which the foregoing is but a very faint outline.

Under all the varied circumstances in which both crews were placed, we cannot but admire their calm, patient endurance of the greatest hardships, and the simplicity with which every event is recorded. Often in touching words, yet always in plain, manly language, such as we know and feel to be sincere, truthful and most accurate, they have given us faithful narratives of their adventurous voyages.

On the conclusion of the paper, the CHAIRMAN remarked that Pendulum Island, where the *Germania* wintered, was the very spot where Lieutenant (now General Sir Edward) Sabine first conducted those magnetic experiments which have since made his name famous throughout the world, and he was so much impressed with the importance of the German Polar Expedition, that he gave it a prominent place in his last anniversary address to the Royal Society, and spoke of it in terms of very great praise.

The meeting would be much interested in learning that Sir Roderick Murchison had taken the liveliest interest in the subject, and had suggested to him (Sir H. Rawlinson) that he should impress upon the Fellows the very great importance of following up these Greenland discoveries. Sir Roderick especially desired him to point out to the members of the Yacht Club, and to Alpine travellers in general, the great advantages that might be derived from

their turning their attention in that direction, especially in regard to the exploration of the deep fiord discovered near Cape Franklin. The climate appeared to be anything but disagreeable; the scenery was very fine, and the sport was of a most exciting description. Above all, there was a grand geographical problem to be solved in reference to the possibility of there being an open Polar Sea north of Greenland; and most likely, if it ever was solved, it would be by proceeding up one of these large fiords.

Captain SHERARD OSBORN said the drifting of the crew of the *Hansa* on the ice-floe, southwardly along the coast of Greenland, was a remarkable proof of the existence of the Polar current. A similar voyage had been made by two Arctic navigators, though not of the extent of this journey of the Germans. Sir Leopold M'Clintock, fourteen years ago, was drifted in the *Fox* right down into the open sea, after passing through no ordinary dangers; but on that occasion he saved his ship. The *Resolute* also was caught in the ice, and came right through to the open sea. The case of the *Hansa*, however, was the first occasion on record on which, after losing their ship, the crew had saved themselves on the floating ice, and it was a very creditable thing to find a young sailor-nation doing its work so well. He was not at all astonished at the abundance of animal life stated to have been observed in Greenland. At the Danish settlement of Upernavik, in lat. 72° 48' N., sufficient reindeer are shot every summer and autumn to feed the inhabitants throughout the winter. The Esquimaux are found as far as 80° N., in Smith Sound, on the western side of Greenland, and they live upon animal food. These people speak of musk-oxen being found still further north. On Melville Island, which is surrounded by an almost impassable barrier of ice, Sir Leopold M'Clintock in 1852, with his sledge-parties, supplied all his crew with fresh meat nearly every day from the herds of musk-oxen and wild reindeer they found there. M'Clure, too, found abundance of animal life on Banks Land, though it also was surrounded by an impassable sea. The animals there seemed to wander into the interior at certain times, and at others to return towards the coast; but they remained on the land itself. There was, therefore, no reason to doubt that in Greenland these animals are indigenous, and probably in the interior there are vast plains sheltered by lofty mountain-ranges, affording plenty of herbage and means of supporting animal life. He did not think it was at all a singular thing that a large fiord had been discovered. It was a question whether the southern part of Greenland is not cut up by numerous fiords, some even running right across. The Esquimaux speak of one running across, and the old Norsemen traditions are to the same effect. The great object of Polar research is to penetrate that area which lies round the North Pole, for the purpose of setting at rest the long-disputed question of the existence or non-existence of an open Polar Sea. He firmly believed that there was no such open sea. Six years ago, in a paper read before the Royal Geographical Society, he had proposed as the best route for such an expedition the one by Smith Sound, making the starting-point 82° N., the furthest which had hitherto been attained on the west side of Greenland. Professor Petermann, however, maintained that a route could be found between Spitzbergen and Greenland, and he was supported in that view by General Sabine and some Arctic authorities. The failure of all attempts in the direction pointed out by Dr. Petermann proved he was wrong, and although quite ready to bear witness to the heroism of the officers and men of the German Expedition, he (Capt. Osborn) asserted that their efforts had been entirely misdirected by Dr. Petermann, and the result was, as he had anticipated, no addition to our geographical knowledge of the Polar Basin.

Mr. E. WHYMPER said it was a very old notion that there is a fiord running from one side of the country to the other, and such a fiord was laid down in the map which accompanied the Danish edition of the first Egede's book

upon Greenland, published nearly a century and a half ago. In this map the fiord is made to run from Disco Bay down to about latitude 65½° upon the east coast. The last time this notion was prominently brought forward was by Captain Scoresby, who supposed that communication existed between Jacob's Bight (Jakobshavn fiord), and Scoresby or Davy Sound. In 1867 he (Mr. Whymper) was in Greenland, and made it his particular business to inquire about this fiord; but, although he ascended several hills about 3000 feet in height in the vicinity of Jakobshavn, he saw nothing whatever of it. He would not say it did not exist, but at all events he did not see it. The country about 70° N. was completely covered with glacial ice up to a great altitude, and at the summit formed a dead level. There is, however, a considerable district to the south, between Holsteinborg and Egedesminde, which has never been surveyed, and here the western opening of the fiord may possibly be found. A notable instance of the extent to which the stream of ice down the east coast may obstruct navigation occurred in the winter of 1863-4, when the Danish ships which were at Godthaab and Julianahaab were unable to get through that stream of ice, while the ships from the northern settlements came home in safety. Musk-oxen were entirely unknown in the district he visited, and the natives said there were only two reindeer left, which knew everything, and would not let the men get near them.

Admiral COLLINSON said he was one of those who supported Captain Sherard Osborn in advocating the starting from the opposite or western side of Greenland, and he was glad to find that his surmises had turned out to be correct. The German expedition had proved that progress along the eastern side is impracticable. But the most important discovery in the late voyage was that of the existence of abundance of animals in that part of Greenland. The musk-oxen and reindeer had no doubt been driven from the coast of America by the Esquimaux, and they can be traced in Melville Island, but it is an important question how they got from Cape York to the opposite side. They may have gone round by the north, or by the south, or have followed a fiord penetrating far inland. The musk-ox has not found its way to Spitzbergen, though the reindeer has. No doubt some of the interior fiords, in consequence of their confined space and the heat of the sun penetrating into them, afforded grasses capable of sustaining these animals, and he was inclined to believe that there is a channel through the country.

Dr. RAE thought that the German expedition would have advanced some hundreds of miles further if they had put off their journeys until later in the year. They wasted their energies by trying to advance in the winter, when it was very cold and stormy. If they numbered fifty or sixty, they might have employed small parties in preliminary journeys, and kept the best men for more extended exploration in the spring. From his own experience, he had found it advisable to postpone his journeys till the end of March or beginning of April, and in consequence he had been able to make progress hauling heavy sledges 20 miles a day and travel upwards of 1000 miles—500 out and 500 back in one journey. He believed the musk-oxen which had been found by the German Expedition had been driven in that direction by the Esquimaux, seeking safety away from the haunts of men. The reindeer in Spitzbergen most probably came from Norway, as the American deer is, he thought, a variety distingushed by its slighter limbs. The musk-ox would never migrate to that distance across the ice. He was of opinion that a journey across the continent would be most interesting and practicable, although towards the south the country was a mass of ice.

The CHAIRMAN considered the reports of the German Expedition to prove that there was a great contrast between different parts of Greenland. No doubt Southern Greenland, which Mr. Whymper saw, formed one vast glacier, but in

the more northerly and easterly district visited by the Germans the glaciers appeared to be insignificant; in fact, there was very little footing for glaciers to hang upon, and the climate seemed quite different from that of the southern region. Probably, if Mr. Whymper had been in 75° N., instead of 70°, he would have enjoyed the ascent of the mountains, for the Germans found no difficulty in ascending a mountain 7000 feet in height, and they perceived another at some distance which they calculated at 15,000 feet. One curious fact connected with the animal life observed by the Germans was, that when General Sabine visited the same region in 1823, no musk-oxen or reindeer were to be found there, and, in fact, until this last visit, no traveller had ever seen them in that quarter. They must have come, therefore, either round the coast by the north or along some interior valley or fiord. The great problem to be now solved was, what is the northern coast of Greenland, and is there any open sea stretching thence to the Pole. This would probably best be ascertained by penetrating to the interior of Greenland by means of the fiords, and then striking northward until the coast was reached.

Sixth Meeting, February 13th, 1871.

MAJOR-GENERAL SIR HENRY C. RAWLINSON, K.C.B., VICE-PRESIDENT, in the Chair.

PRESENTATION.—*Rev. J. B. Harbord*, M.A.

ELECTIONS.—*Major N. M. Bell; H. M. Blair, Esq.; Henry Blyth, Esq.; Charles Wynne-Finch, Esq.; Rev. Richard Valpy French; Wilfred Huddlestone, Esq.; Major W. W. Knollys; Henry Mawbey; Douglas Merritt, Esq.; Ernest A. C. Schalch, Esq.; John Taylor, Esq.; Thomas Sutton Townsend, Esq.; Captain E. F. Trivett*, R.N.R.; *Rev. James Wallace.*

ACCESSIONS TO THE LIBRARY FROM JANUARY 23RD TO FEBRUARY 13TH.—'Travels in South and Central America.' By Don Ramon Paez. New York, 1868. 'Paraguay.' By G. F. Masterman. 1869. 'Seasons with the Sea Horses.' By J. Lamont. 1861. 'The Magyars.' By A. J. Patterson. 1869. 'Notes on Corsica in 1869.' By T. M. A. Campbell. 'A Month in Russia.' By E. Dicey. 1867. 'Central America.' By Julius Froebel. 1859. 'Travels of A. M. Frere (Mrs. G. Clerk).' 1870. 'Travels of J. Van Lennep in Asia Minor.' 1870. 'Travels of G. M. Mackenzie and A. P. Irby.' 1867. 'Travels in the Levant.' By C. T. Newton. 1865. 'Sketching Rambles in the Alps.' By A. and M. E. Catlow. 1861. 'Scientific Guide to Switzerland.' By J. R. Morell. 1867. 'La Plata,' &c. By A. J. Kennedy. 1869. All the foregoing by purchase. 'Œuvres de Champlain.' Par l'Abbé C. H. Lavedière. Quebec, 1870. Donor M. George E. Desbarats. 'Trade Unions Abroad,' &c. By the Hon. T. J. H. Thurlow. 1871. Donor the author. 'Appendix to B. Anderson's

Journey to Musardu,' &c. New York, 1870. Donor Sir R. I. Murchison. 'Official Narrative of the Expedition to Explore Trade-Routes to China, *viâ* Bhamo.' By Major E. B. Sladen. Calcutta, 1870. Donor the author.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING OF JANUARY 23RD.—A Map of the Metropolitan Railways, Tramways, &c., for 1871. Presented by E. Stanford, F.R.G.S. Chart of the first German North-Polar Expedition in 1868 under K. Koldewey. Presented by Dr. A. Petermann. Chart of Hinlopen Strait, Spitzbergen, under K. Koldewey. Presented by Dr. A. Petermann. Chart of the Summer Sea-surface Temperature on the West Coast of Nova Zembla and in the Kara Sea. By Dr. Bessel in 1869, and the Norwegian Expedition of 1870. Presented by Dr. Petermann. Chart of Soundings on the West Coast of Nova Zembla, and in the Kara Sea, by the Norwegian Expedition in the Summer of 1870. Presented by Dr. Petermann. The War Register, No. 11, of February 11th, 1871. Presented by Keith Johnston, jun., F.R.G.S.

The CHAIRMAN said that as anything connected with Dr. Livingstone was always an object of deep interest to the Members of the Society, he was sure no apology was needed for opening the proceedings that evening with extracts from a letter recently received, in which, although nothing was communicated direct from that illustrious traveller, some additional information was imparted in reference to him. The letter was addressed to the Secretary of State for Foreign Affairs.

The following letters were read :—

1.—*Letter from* Mr. CHURCHILL, *Consul at Zanzibar, concerning* Dr. LIVINGSTONE.

"MY LORD, "Zanzibar, November 18th, 1870.

"After a vast amount of delay, that will appear unnecessary to those who are not acquainted with the country, I have succeeded in sending off to Doctor Livingstone a reinforcement of seven men, who have engaged to place themselves at the disposal of the Doctor, as porters, boatmen, &c., and a quantity of beads, clothes, and provisions for his use. He will receive, by the same opportunity, the letters and papers confided to me by Lord Clarendon and the Geographical Society, together with some wearing apparel sent by the Doctor's relatives. I am in hopes that these will reach Ujiji in the month of February, but nothing certain can be said about it. In a future despatch I will send an account of the expenditure attending this Expedition. News was received about a month ago of the arrival at Unyanyembe, in June last, of men and supplies sent up in October 1869 by Dr. Kirk; seven of the men had died of cholera, and the remainder, having consumed the provisions forwarded for them, had, with the advice of the Governor of Unyanyembe, drawn upon the supplies of which they were the bearers for their subsistence. This, at first sight, appears preposterous; but, on consideration it may be explained by the fact that, without supplies from some source or other, the progress of the caravan would have been stopped, and, in the absence of an authority to

that effect from the Sultan, the Governor of Unyanyembe refused to grant the necessary subsistence-money.

"The latest accounts from the interior state that Dr. Livingstone, after visiting a place called Manime, had returned to Ujiji."

The CHAIRMAN, in continuation, said the letter from Dr. Kirk, mentioned in Sir Roderick Murchison's letter to the 'Times,' was three weeks later in date than that of Mr. Churchill, and, as he (Dr. Kirk) did not state that Dr. Livingstone had really arrived at Ujiji, although deriving his information from the same source as Mr. Churchill, it would be seen that the latter had announced the event, as it were, by anticipation. Dr. Kirk merely said that a letter written in Arabic had been received from the chief of Unyanyembe, dated July, 1870, and stating that Livingstone was expected to arrive in Ujiji at the same time as the men and stores which were then on their way to the same place. It also stated that the traveller had been to a distant country called Manime. To understand the importance of this communication, it was necessary to refer to the last letter written home by Dr. Livingstone himself. It was one addressed to Dr. Kirk from Ujiji, and dated 30th May, 1869. In it, Livingstone said, "As to the work to be done by me, it is only to connect the sources which I have discovered, from 500 to 700 miles south of Speke and Baker's with their Nile. The volume of water which flows north from Lat. 12° s. is so large I suspect that I have been working at the sources of the Congo as well as those of the Nile. I have to go down the eastern line of drainage to Baker's turning-point. Tanganyika, Nyige Chowambe (Baker's?) are one water, and the head of it is 300 miles south of this. The outflow of this, whether to Congo or Nile, I have to ascertain. The people west of this, called Manyema, are canibals, if Arabs speak truly. I may have to go there first, and down Tanganyika, if I come out uneaten, and find my new squad from Zanzibar."

We might infer, from a comparison of these two letters, that Dr. Livingstone did cross the lake from Ujiji to the western side, and had then proceeded to its south-western extremity, in order to explore that unvisited lake and to ascertain the further direction of the waters which he had traced up from the south. The name Manyema was very similar to Manime, mentioned in the Sheikh's letter as the place from which Dr. Livingstone was returning.* It was very probable that this name might be the same as Nyam-Nyam, which is applied to tribes further north. At any rate, Dr. Livingstone appeared to have carried out the plans mentioned in his former letter; and, if the Arab chief's information was true, he (the Chairman) could see no reason why he should not reach England before the end of the present session. If he arrived at Zanzibar during February or March, he might, *viâ* Aden, be in England by the end of June. He (the Chairman) sincerely trusted that it might so happen, and that our venerated President, Sir R. Murchison, might be brought to the hall of the Geographical Society to welcome him on his return.

Dr. BEKE said that probably the Nyam-Nyam represented the cannibal negroes, the *aithiopes anthropophagoi* of Ptolemy, described by that geographer as residing on the west of the Barbarian Gulf. Their precise locality was not known. The name Nyam-Nyam was merely another form of the Lem-Lem, Yem-Yem, or Dum-a-Dum, of the Arabian geographers.† Dr. Schweinfurth had lately passed over the country which in Petherick's map is marked "Nyam-Nyam," but had found no cannibals there, though he was told there

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* Sir H. Rawlinson, having subsequently examined the Arabic orthography of this name, as copied by Dr. Kirk from the Sheikh's letter, ascertained that three distinct readings were given:—1. Manyema; 2. Mánimiya; and 3. Naniyema.

† See Dr. Beke's work, 'The Sources of the Nile,' p. 72.

were some further on. Their locality must, therefore, be very near that which has been visited by Dr. Livingstone.

2.—*Letter from* Mr. FREDERICK DREW *to* SIR RODERICK MURCHISON, *on the Death of* Mr. HAYWARD.

"Jummoo, near Sealkote,
"21st Dec., 1870.

"DEAR SIR RODERICK MURCHISON,

"I am sure you will be anxious to learn all that can be known about Mr. Hayward's death; and I am glad to be able to give you some particulars that probably have not yet reached you. I was in Baltistan when the news of the event which has caused so much regret to all Hayward's friends, among whom I count myself, reached the Maharaja of Kashmir, and he sent orders for me to go to Gilgit, and make a thorough investigation into the circumstances: this I did to the best of my power, and have just now returned to Jummoo. I wrote a full report of all I could learn, which report the Maharaja has sent to the Lieut.-Governor of the Punjab, so it may reach you through Government; still I am desirous to let you know the result of enquiries in Gilgit without any delay.

"No doubt Mr. Hayward gave you a full account of his first journey to Yāsīn; you will therefore have heard of the friendly way in which Mīr Wallī received him that first time, and will have seen how completely Mr. Hayward believed in him. Those more used to the two-facedness and the avarice of the people of those parts—developed to an extreme in their rulers—doubted the sincerity of Mīr Wallī's friendship, and saw cause enough for his civility in the presents given and in his hope for more afterwards, as well as in the wish that he had to make a political use of Mr. Hayward. I did not meet Mr. Hayward between his two journeys to Yāsīn—having missed him at Sirinagar by but a day; but I heard from him by letter, and heard from others, of much that he had experienced. It was clear that he had put away from him all fear of the Yāsīn people, and was most sanguine of the success of his expedition.

"As all details of his last journey will be welcome to you, I will now give the particulars I learnt.

"Mr. Hayward reached Gilgit on the 7th July, and left it for Yāsīn on the 9th; he had much more baggage than on his first journey—then fourteen coolies carried the camp, now thirty-three were required,—and he had these servants:—a munshi, a khansaman (Kashmiri), a chuprasi (Kashmiri), and two Pathāns, whom he met and took into his service at Gilgit. I believe that he reached Yāsīn in five days, that is on the 13th July.

"For what happened after his crossing the Maharaja's border, we have evidence of various degrees of trustworthiness. There is the statement of Wazīr Rahmat, a former acquaintance of mine, who was Mīr Wallī's wazīr, but who, after the murder, fell away from him, and compassed his expulsion from Yāsīn. This we have in two forms—by a letter and by word of mouth from an agent he sent in to Gilgit; then there are some letters written to us by Imān-ul-Mulk, Raja of Chitrāl; and again there is the information got by messengers whom we sent to Yāsīn. From these materials a connected view of the last events in Mr. Hayward's life can be made out, and one which, from the corroboration of statements derived from various sources, deserves, I think, considerable confidence.

"Wazīr Rahmat says, that on Mr. Hayward approaching Yāsīn, Mīr Wallī went some miles out to meet him, and, on coming within hail, got off his horse; but that his visitor did not pay the same respect, but remained mounted

till quite near, and that Mīr Wallī was somewhat offended at this. We have no corroboration of this statement of Rahmat's, and if anything of the sort did occur, we may be sure that it was simply from Mr. Hayward not knowing what exactly was expected of him; nor is it likely that this of itself would have led to any serious consequences. Mr. Hayward pitched his camp in Yāsīn, and stayed there two days, Mīr Wallī coming twice or thrice to visit him within that time. During one of these visits, Mīr Wallī asked what had been done in the matter of getting his right—or supposed right—to Gilgit recognised by the Governor-General, for which purpose he had sent an agent to the Punjab, in company with Mr. Hayward. Nothing having been effected in this (the agent himself not having stayed to prosecute the suit), Mr. Hayward could not give any answer that would be satisfactory to people unused to the delay necessary for careful investigation and consideration. Mīr Wallī, it seems, had built much hope on Mr. Hayward having originally undertaken to represent his case, and was proportionally disappointed at nothing having resulted from it.

"Then we hear, through Rahmat, that Mr. Hayward asked for coolies to carry his camp to Badakhshān by the straight road, while Mīr Wallī desired him to take the way to Chitrāl, whence he might be passed on by the Chitrāl Rāja. It seems that the Rāja of Chitrāl had given orders for him to be sent on to him. Certainly he wished to see him; and on this occasion Mīr Wallī (who had on the first visit dissuaded him from going there) pressed him to go there, probably thinking it better that the Englishman should go to Chitrāl and part with his goods there than pass altogether out of the family territories,—or perhaps he had, since the first visit, received such orders about this as he dared not disobey. This argument between the two was conducted with a good deal of warmth. The accounts say—but I am unwilling to believe them—that Mr. Hayward called Mīr Wallī by a hard name that he was likely to resent. However, Mr. Hayward kept to his purpose (which was to go by as straight a road as possible to Pāmir), and Mīr Wallī gave in and provided coolies; and probably then only, when he saw the coveted goods going out of his reach, formed the design against Mr. Hayward's life.

"The progress of the camp was slow: the marches made were—Saudī, 3 miles; Hundar, 5 miles; Darkūt, 6 or 8 miles. It is not unlikely that delays were purposely interposed; at the same time it must be remembered that carrying heavy loads is by no means a practice in that part of the world, and the coolies very likely refused to go beyond their own bounds, and so caused delay too. I reckon that Mr. Hayward's camp reached Darkūt on the afternoon of the 17th July.

"Mīr Wallī having made up his mind to plunder and murder his guest—the man who had done his best to serve him—sent Shāh Dīl Imān, one of his relations, and Kūkalī, a man well known in Yāsīn, with, some say, as many as sixty men. These reached Darkūt in the evening of the same day that saw Mr. Hayward arrive there; and the collection of so many in a small village aroused attention, and—although Shāh Dīl Imān said he had been sent to see Mr. Hayward safe over the Pass—even suspicion. There had been yet another cause for doubt in the mind of Mr. Hayward, in some words which Mīr Wallī had let fall to one of the Pathans, when trying to persuade him to leave his master's service; so much influence had these doubts on Mr. Hayward that he sat up all that night prepared, expecting an attack. The headman of the Darkūt village describes him as sitting in his tent, with the candle burning, with guns ready on the table before him, and writing, but in his left hand holding a pistol. No doubt, he thought that if he could tide over the danger of this night he might escape free, for close in front of his camp was the ridge, the boundary of Mīr Wallī's country, which crossing in the next march he would have reached Badakshān territory, out of reach of Mīr

Wallī's treachery, and have had new countries before him to find his way through.

"It was not, however, to be. The watch kept certainly deterred his enemies from an attack during the night; but these people are masters in the kind of warfare that consists in surprises: they waited their time, and when, by sunrise, Mr. Hayward, thinking all danger over, lay down to take an hour's rest before the day's march, their opportunity had come. The position of the camp helped their design: it was at a little distance from the village, in a small garden at the edge of a thick pine-forest; in this they could collect their men, and even stand them near to the tents without observation. It seems that they did this on finding out that the object of their wiles was asleep, and then Kūkalī entered the tent with a rope, picked up from among the baggage, and while others came on and held in check and bound the servants, he, aided by more, seized Mr. Hayward and bound his hands behind him; and then they led both him and his servants away from the camp into the forest, for a distance of a mile or more, Mr. Hayward on the way offering them a ransom for his life. When they had come that distance they stopped, and Shāh Dīl Imān, drawing his sword, cut him down with a blow on the neck that must have killed him at once; and this was while he was in the act of saying a prayer. At the same time four out of the five servants were killed close by; the bodies were covered up with heaps of stones, and so left.

"The evidence of most of this that has been recounted comes from two separate and independent sources: first, Wazīr Rahmat's letters, and the statement of the agent present; secondly, the account of the head-man of Darkūt, given to Gufār Khan, our sepoy, who went to that place afterwards. That, however, you may understand how it was that we received these accounts, I must tell what next occurred in Yāsīn.

"Wazīr Rahmat was not in the murder, and he says that he tried to dissuade Mīr Wallī from it. Now Mīr Wallī designed, first of all, to keep the whole thing a secret from the Maharaja's authorities and the British, and in Rahmat he saw a channel by which the news might ooze out; it was natural, too, that he should be incensed at his wazīr being less guilty than himself: hence he designed to kill him. But in Rahmat he met his match. Getting private news of the plot, he sent his son to Mastūj, the Rāja of which place was Pahlwān Bahādur, who equally with Mīr Wallī was tributary to the Chitrāl Rāja; there a scheme was made to displace Mīr Wallī, and, with the consent of Raja Man-ul-Mulk, Pahlwān Bahādur brought a force of 500 men to Yāsīn before Mīr Wallī had time to prepare a resistance; so he fled away by the Darkūt road, and Pahlwān Bahādur reigns in his place with Rahmat as wazīr.

"Mr. Hayward's munshī, who had been kept prisoner up to this time, was killed by order of Mīr Wallī, when on his flight he reached the same village of Darkūt.

"No sooner was the new state of things established than agents came to Gilgit to apprise the Maharaja's officials of the change, saying that Rāja Man-ul-Mulk had deposed Mīr Wallī in punishment for his having murdered the Englishman. The agents from Chitrāl and Yāsīn were in Gilgit when I reached the place. Rahmat's special messenger I at once sent back, having got from him (not without taking advantage of his natural cupidity) a promise that he would send in Mr. Hayward's body; with him I sent Gufār Khān, who went to the place of the murder, uncovered all the bodies from the loose stones, buried on the spot those of four of the Muhammadans who had been killed, the fifth not being found, and brought Mr. Hayward's body into Gilgit, where it reached me on the evening of the 26th October. The next morning we buried him in a garden near Gilgit Fort. A detachment of troops fired three volleys over his grave.

"Gufār Khān's whole statement is of such interest that I send it in full with this letter; I think you will be glad to hear that the Maharaja has promoted him to the rank of Jemadar, and has otherwise rewarded him.

"They at the same time gave over to Gufār Khān a few of Mr. Hayward's goods, declaring that the rest were taken away by Mīr Wallī in his flight. Those we recovered will be made over to the Punjab Government: they include some books, loose papers, and maps. The papers I looked over, to see if anything were written that might give help in finding out the cause of the murder, but there was nothing of late date.

"You will like to know the last news of Mīr Wallī. He was pursued as far as the Darkūt Pass, but got away, with the loss of a few followers, to Badakhshān; soon afterwards, however, he turned from there, and came to Chitrāl and asked forgiveness of the Rāja, and he has so far received it that he is now allowed to live there. We have sent back the Chitrāl Vakeel with a demand that he should be given up; but it is hardly likely to be agreed to, though Imān-ul-Mulk may insist on his leaving Chitrāl. There are few places where he would be safe from the influence both of the British Government and of the Maharaja; but one there is—Swāt, and there I think it likely he will take refuge.

"Mr. Hayward's death produced much regret among all who had met him—I speak of the people of the countries he had lately passed through. Many were the enquiries made of me as to the truth of the reports of it that had spread, and deep was the pain which my answers caused. All who had had intercourse with him took pleasure in praising him for his courage and energy and for his pleasant manners.

"The Maharaja desires me to say that if any of Mr. Hayward's friends or the Royal Geographical Society desire any inscription to be placed over his grave, and will communicate it, he will be glad to have the tablet executed in India, and will direct that the stone be properly placed. I put a wooden cross at the head of the grave till something else should replace it.*

"Believe me to be sincerely yours,

"FREDERICK DREW."

Statement of GUFAR KHAN, *Sepoy (now Jemadar) of the Maharajah's Irregulars.*

"I went to Yāsīn with Mushan, in order to get Mr. Hayward's corpse and obtain as much information as I could about his death.

"I will tell first what I heard from Wazīr Rahmat. He said that Mr. Hayward showed Mīr Wallī all the things he had brought for presents for the various chiefs he would meet, but that he gave not a thing to Mīr Wallī himself. Mīr Wallī even arranged that he should come to his durbar, thinking him more likely to give a present on that occasion; and he came, but there also made no present. Rahmat, as well as others, repeated what has before been told about Mr. Hayward using a hard word to Mīr Wallī. He said that Mīr Ghāzi, Mīr Walli's relation, was one of those who tried to dissuade him from committing the murder; Sūjā or Sūjāk and Shāh Dīl Imān were among those who prompted and advised him to the deed; that after the murder Mīr Wallī became silent, said hardly a word to any one, even up to the time of his flight.

"Now I will tell what I heard from the Lumbardar of Darkūt with whom I had free communication:—

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* The Council of the Royal Geographical Society have availed themselves of this offer, and a suitable inscription, drawn up by Sir Henry Rawlinson, has been sent, through Mr. Drew, to the Maharaja.—[ED.]

"'The sahib came to Darkūt in the afternoon, and encamped in a garden, close to which is the forest. Shāh Dīl Imān came the same evening with sixty men; he went to the house of one Rustam, who asked why he had come with so many people, to which he answered that he had orders to see the sahib safe across the Pass. There being some communication between these new comers and the coolies who were with the sahib, it reached even to his munshī's ears that there was cause for apprehension, and he informed his master. That night the sahib did not eat any dinner, but only drank tea, and sat watching the whole night in his chair with guns and pistols before him, and a pistol in his left hand while he wrote with the other. In the morning, after taking a cup of tea, he lay down for an hour or two's sleep. Shāh Dīl Imān having sent a man to see, and found that he was sleeping, took his men by a round to the ground in the forest above where the tent was, and then himself coming, asked the Khansaman if he were asleep: on his being told that he was, Kūkalī entered the tent. One of the Pathan servants asked what he was about, and took up a stick to stop him, but others coming round and keeping the Pathan back, Kūkalī went into the tent and caught the sahib by the throat, and, more at that moment coming in, put a noosed rope round his neck, and, with the same rope, tied his hands behind him. The servants were all overpowered and bound at the same time. Then they brought the sahib, thus bound, away from the village into the forest for a distance of a mile or a mile and a half; and as they were going he tried to induce them to spare his life by promises, first of what was in his boxes,—but that, they jeeringly said, was theirs already; then of a larger ransom to be obtained from the English country; and, lastly, he said he would write to the Bukshee at Gilgit for money for them. This, however, they would not listen to. Then the sahib asked for his munshī to be brought, but he had been taken off in another direction, and could not quickly be found; then they took the ring off his finger, and then Shāh Dīl Imān drew his sword, on which the sahib repeated some words which seemed like a prayer, and Shah Dīl Imān felled him with one blow. Then Kūkalī brought the sahib's own sword, and said he should like to try it; so he struck a blow with it on the sahib's body. It was 8 or 9 in the morning when the murder was committed.'

"Thus far the lumbardar. As to my own doings; they gave me a horse to go on to Darkūt. Arriving there in the evening, I at once went to the place they pointed out to me, and saw the heaps of stones that covered the bodies. They would not tell me which was that of Mr. Hayward; but I saw protruding from one a pair of hands crossed and bound together, the palms turned upwards, and at once I recognised them as those of the sahib, not by the colour, for that was changed, but by their form. Clearing the stones away, I saw by the hair and beard that this was indeed the sahib's body; so I brought it into the village. The rope round the neck had been severed by the sword-cut, but the hands were still bound behind. The next day I opened four other heaps, which covered the bodies of Mr. Hayward's servants. Those who had been killed at the same time as their master had been much cut about, but the body of the munshī (who was killed later) had but one wound, in the back of the neck. His body was found in the village, not in the forest. These four I buried on the spot; the sahib's remains I have brought to you in Gilgit. The Kashmiri chuprasi I could find no trace of, though the people said he had been killed at the same place.

"I have learnt also that there was really a pursuit of Mīr Wallī by Pahlwān Bahādur's people. On hearing of the Mastūj force being on the way, Mīr Wallī went to Darkūt with all his family and goods. He stayed there two nights; and, during the time he was there, he ordered Mr. Hayward's munshī (whom having kept up to that time, he had now brought with him) to be killed, and that order was carried out. Then, the troops coming more quickly

than he expected, he had to fly suddenly; his family were captured (and afterwards sent to Chitrāl), while three of his men, being wounded, were taken prisoners. These three have since, with the family of one of them, been sold to the Badakhshi traders.

"I was detained for three days at Yāsīn on my return, the authorities making excuses about coolies not being ready, &c.; but their real object was to keep me until orders came from Chitrāl. I believe that orders did come for me to be allowed to return with the sahib's body; for now they have mounted a post all the way to Chitrāl, and news comes and goes quick.

"Before leaving, I got Pahlwān Bahādur and Rahmat to set free a sepoy of ours, named Bahādur, who had been captured when Gilgit was attacked nineteen years ago, and had been kept in slavery for years there and in Badakhshān. At last he had been set free by Jahāndār Shah of Badakhshan; but on coming through Yāsīn had been robbed and imprisoned by Mīr Wallī, and kept there till now. Pahlwān Bahādur and Rahmat agreed to let him go, but Rahmat's brother—to whom he now belonged—objected strongly. That difficulty, however, was got over, and I have brought him with me.

"They also handed over to me the following goods of Mr. Hayward's—these I have brought with me too:—a pony, a tent, the legs of a table, some books and papers,—and they declared on oath that there is nothing more in Yāsīn that belonged to him."

The CHAIRMAN said that, as far as he had means of forming an opinion, this report might be depended upon. Mr. Drew was a well-known person. He was not in the service of the British Government, but in that of the Maharajah of Cashmere; and of course a great deal depended upon his trustworthiness. Rumours had indeed been spread in India that these accounts were not to be believed, and that the Cashmere authorities were in some way connected with Mr. Hayward's death, but up to the present time, he (the Chairman) had not seen any evidence of a nature to incriminate the Cashmere authorities. Still in a matter of this sort it was well to suspend judgment until we obtained the official accounts.

Sir DONALD M'LEOD (late Lieutenant-Governor of the Punjab), on being invited by the Chairman to state his opinion, said he had known Mr. Drew for some five or six years and had always found him to be a gentleman of perfectly honourable character. So far as his information went, he was a thoroughly trustworthy person.

The following Paper was then read:—

Report on the Kaieteur Waterfall in British Guiana. By CHARLES B. BROWN.

[EXTRACTS.]

DURING the last expedition of the Geological Survey, whilst descending the Potaro River, in April, I came quite unexpectedly upon a large fall, which the Indian guides called "Kaieteur." I was much struck with the beauty and grandeur of this fall, and regretted extremely that I could not remain longer to make proper observations of its height, width, &c. I had, therefore, to content myself with mere estimations, which at best are exceedingly doubtful and unsatisfactory.

His Excellency Governor Scott, deeming it advisable to have the

exact measurement of this fall made known, directed me, on the 24th of June last, to make preparations for a journey to it, for the purpose of making a thorough examination of it with regard to its height and width; stating, at the same time, that Sir George Young, Mr. Mitchell, and Mr. E. King would accompany me. I therefore at once procured the necessary supplies for a month's consumption for our party, and the number of men which I thought it necessary to take.

On Friday, the 1st of July, we started on our journey, and, directing our course across the mouth of the Mazaruni River, entered upon the broad waters of the Essequibo, up which we paddled till 5 P.M., reaching a deserted place called Ouyah, where we spent the night.

At 2 P.M., on the 9th, we entered the mouth of the Potaro River, and found it extremely high, but with very little current, being dammed back by the great body of water flowing down the Essequibo past its mouth. The change in the colour of the water was very apparent, the boats gliding from a turbid stream laden with sediment in suspension at once upon water of a translucent, brownish black, which had a clean, pleasant appearance. Viewed in a body, this water resembles an infusion of tea in colour, and derives its tint from the tannin in it, derived from vegetable matters. At 5 P.M. we reached Tumatamari Cataract, some 5 miles up the Potaro, and found that, though a great body of water rushes over it, yet, from the water at its foot being so high, it is itself greatly reduced in height, being only 6 or 8 feet at its southern side, and a few feet at its northern.

After surmounting several cataracts and rapids during the next four days, we reached the hilly region of the Upper Potaro. At almost every bend of the river fine views of the sandstone mountains were disclosed, uniformly covered with dark-green foliage, excepting here and there, where the steep bare patches of whitish rock formed great precipices. In some places, the almost uniform flatness of the mountain-tops was relieved by deep gorges and gaps. We made good progress against the stream, the current not flowing with much rapidity, and by midday reached Amatu Fall, the approach to which, up a long reach of the river, is very beautiful.

At 7 o'clock next morning, the 15th, we entered the end of the valley, with high mountains on either side, partially shrouded in dense clouds of mist. Soon after, the rain began to fall heavily, and did not cease till after 10 A.M., at which time we reached Warratu. As soon as the rain commenced, all the grand views of mountain scenery were hidden by the mist, and on its clearing off,

as the rain ceased, some fine cascades, pouring down a precipice on our right hand, were disclosed. Warratu is not a large cataract, its portage being about 100 yards long; so that we found it only necessary to carry the stores and luggage over, and consequently were not detained any length of time by it. As the rain-clouds broke away, the sun came out brightly, driving away the mist and fog clinging to the mountain gorges, and thereby disclosing to our delighted gaze a portion of the object of our journey—a view of the Great Fall; far off, at the head of the valley, pouring its foaming water over the precipice-edge into the depths below, as it has done for ages past. One is struck with awe, and impressed by the greatness of Nature's works, when he sees the great power that is here revealed, which, through unnumbered ages, has been cutting its way, unnoticed, back from the mountain-edge at Amatu to its present position, thereby forming this broad and deep valley. As it receded from its first position—when it probably poured its waters into the ocean then washing the base of the sandstone cliffs—its branch streams, running in at right-angles, helped in this great work of denudation by cutting side-gorges and widening the whole valley. Viewed from where first seen, I should say that some 400 feet of it, from the top downwards, can be seen, and about one-half of the width of the top; a bluff hiding the rest. Every now and then, clouds of thin white mist from the foot rose up and covered it like a veil, and then passed away to the eastwards, the breeze being westwardly at the time; but one cloud, I observed, always crept along the precipice under its western edge, as far as could be seen from here, and is the one that rises from its western foot, which, in early morning, I saw on my first visit.

Before passing the Partamona village, we met some Indians, to two of whom I communicated, through the interpreter, that we wanted guides, on the following day, to the foot of the fall, and as much fresh provisions as they could supply. Soon after this we reached the "Landing," at 2·30 P.M., at the foot of Tuknie Cataract, about 3 miles from the foot of the fall, at which we landed all the stores, knowing that we could proceed no farther in our boats. Another Indian came up to see us, and from him I learnt that, on account of the number of small cataracts beyond Tuknie, we should have to pursue our further journey on foot.

The Indians brought us, on the following morning, a large quantity of sweet potatoes, plantains, &c., which we bought with beads and knives. By 8 A.M., everything being ready, we started, with two Indians as guides, and five of our men as carriers of provisions, &c., and were accompanied by eleven Indians, who

escorted us of their own accord. We traversed the well-beaten path which leads to the head of the fall for a few hundred yards, and then struck off to the river, coming out on its western side at Orimedonk Cataract. Here the path ended, and we followed the river's edge, sometimes amongst blocks of rock and boulders, close to the water, at others some few yards in the forest amongst great massive rocks, and having often to cut our way through thickets of tangled vines. At 10·45 A.M. we reached a spot about a quarter of a mile from the foot of the fall, at a point from which its whole force could be seen. This is, perhaps, the best view of the actual fall and precipice, on either side, that can be obtained, and one can here fully realise its immense height. The day was dull and cloudy, and some rain fell soon after we reached this spot, causing a dense mist to hang about the fall.

I chose a good barometrical station, 13 feet above the level of the water, and compared the two barometers, so as to get the difference between them.

The party at our bivouac that night consisted of Mr. King, six men, three Indians, and myself. We had poles rigged up and lashed together under a large flat rock, in a kind of cave, and there hung our hammocks for the night in this most romantic spot, with a frowning precipice on either side, and the fall in front, with its ceaseless roar sounding in our ears.

Sitting over the fire that night, the interpreter related to us a tradition connected with the fall, and from which it derives its name. The story commences, as usual, with "Once upon a time" there lived an old Indian at a village above the fall—an exceedingly feeble old man—whose feet became infested with Chigoe fleas to such an extent that he gave his friends and relatives an immense amount of trouble in picking them out for him every morning; so they determined to rid themselves of the nuisance, and accordingly placed the old man, in a woodskin, just above the edge of the fall, and shoved it out into the stream. The strong current hurried him to the brink and swept him over in its foaming water, and he was seen no more. But not long after, strange to relate, his woodskin appeared at the end of a small island, in the smooth stream just below our camp, in the form of a long slab of rock; while on a slope, on the right-hand side of the fall, a large square rock represents his canister, similarly petrified. After this tragedy had been enacted, the Indians named the fall Kaieteur, which means Old Man Fall."

Just before the moon appeared above the mountain on the left, two bright stars rose in the sky beyond the edge of the fall above,

seeming to come out of the very water; and then the first light of the moon rested on its crest, shedding a golden light across it, which had a most beautiful and charming effect. After this, till morning broke, all the water was lit up by the moon's rays, and could be seen with great distinctness.

Early next morning, as the sun shone on the mist, on the right-hand of the fall, a beautiful rainbow was produced, reaching from its foot to almost half-way up the precipice. The day was fine, and I continued my pencil-sketch. At 8·45 A.M., Mr. Mitchell and some of the men appeared at the edge of the head of the fall, on the western side, looking extremely small. We exchanged signals to set up barometers, and soon after signalled each observation, taking five simultaneously during the interval between 9 A.M. and 10·30 A.M. We next tried to measure the width and take the depth of the river, Mr. King swimming with the line; but the current was too strong, and swept the line down-stream with such force that we could not manage it. In the afternoon, I twice observed that a strong breeze issued from the cave behind the falling water, driving the eastern edge of the fall outwards, and giving a quarter-turn to the bottom of the column of water. Mr. Ring, the men, and myself, walked back to the camp at the Landing, which we reached at 5 P.M., and met Sir G. Young and Mr. Mitchell there. Getting the result of the upper observations, I made a rough calculation from the means of both, and found, to the satisfaction of all, that the height came almost up to our expectations. In this I did not allow for the mean difference between the two barometers, which was subsequently taken into the calculation.

On the following morning, the 18th, Sir G. Young and Mr. Mitchell started, on their return, in the two small corials with six men, and were accompanied by two Indians in a woodskin. At Tumatamari they were to leave the corials and descend the Essequibo in the *Lady Woodhouse*. Mr. Ring and myself started for the top of the fall at 10·15 A.M., taking six men and an Indian with us. The path was good, and the ascent gradual for some distance; then became rather steep, for a few hundred feet, to a gully filled with immense blocks of sandstone, between the interstices of which a small stream runs. From this the path leads up the mountain, at a steep angle, for a distance of about 400 feet; then the ascent becomes gradual again to the top of the table-land, over 1000 feet in vertical height above the starting-point. It then leads along the table-land, in a south-westerly direction, for a considerable distance, coming out of the forest about three-quarters of a mile from the head of the fall, on a small open tract of country. The

walking is then over flat rocks, through low shrubs and bush, to the head of the fall. We arrived there about an hour after midday, and commenced a series of measurements. We tried to measure the height of the fall with a line and weight run through a pulley over the edge of the precipice; but, when over 500 feet had been paid out, the mist given off by the side of the fall completely hid the weight and lower portion of the line from view, and we had to abandon the experiment. We found an old woodskin in a small creek near by, in which I crossed over with a man to the other shore, at a distance of 250 yards above the edge of the fall, carrying the end of a line with us to measure the width; but the line became entangled in the rocks of the bottom of the river, and we had to cast it off, and go on without it. I next visited the edge of the precipice on the eastern side, and found that the width of the edge of the fall is 30 feet less than it was when I was here in April, by measuring from it to a rock which I then observed was surrounded by water. On the other side the width is 66 feet narrower than it then was. That evening we encamped in some low bush close to the fall. Late in the afternoon swallows came in from all points of the compass, in large flights, and here gathered into two or three immense flocks, and kept wheeling above us, closely packed together, at a height of about 100 yards. I can only convey an idea of the multitude of these birds by saying that they were in myriads. Every now and then, as the flocks passed above the fall, thousands would swoop down almost perpendicularly with extraordinary velocity, and, passing close over the edge, drop till opposite the great cave, then suddenly change their direction, and shoot through the mist on either side to their roosting-places in it. Just before dusk these birds came down in greater numbers, attracting our attention by the strange rushing sound they produced by their downward flight, sometimes pouring down in a continuous stream for five minutes at a time. Then single birds and small flocks kept arriving till it was quite dark. When a single bird shot down, only a black line marking its course, could be seen.

At 6 o'clock next morning the thermometer stood at 70°, whilst the water at the same time was 73°. The great valley below the fall was filled with mist up to 8 A.M., when the breeze sprang up and dispersed it. I continued my observations at an early hour, assisted by Mr King. We measured a base-line of 2·42 chains, and then with a good compass took the angles to a mark on the other side (the rock before mentioned), from which I calculated the width of the fall, as it was in April last, to be 370 feet.

We then took four observations of the velocity of the current before it passes over the fall, to within 50 yards of its edge. Setting two compasses at two points, 66 yards apart, I directed them both at right angles to the base-line. Light pieces of wood were carried out in a canoe some distance above, and allowed to float down. Mr. Ring observed at one compass, while I watched at the other, and timed the floating objects as they passed. I also took five observations with the mountain barometer at the upper station, at the same times as before.

We again took out the line in the woodskin to measure the width of the river at 200 yards above the fall, and were successful. Making the line fast to a tree on the opposite bank, we went back, and hauled it in straight, and thus got the true width, viz., 134 yards. The remainder of the day was spent in making a water-colour sketch of the front of the fall, and of the country from which the river comes, from a spot on the western precipice-edge, not far from where the path emerges from the forest. The day was extremely fine, and the sun shining on the spray caused many beautiful rainbows at different periods, one reaching quite from the top to the foot of the fall.

Next morning (the 20th) we sounded the depth of the water at 200 yards above the fall, and found 15 feet 2 inches to be the greatest depth. On the river's edge there are trees upon which the high-water mark has been left, the water having recently, and evidently for a length of time, stood at a height of 5 feet above its present level. Returning to the same spot as yesterday I finished my sketch, and then we all descended the mountain, and arrived at the camp at the Landing, at 5 P.M.

On the 21st I took five men and an Indian with me, and proceeded to the foot of the fall, to take the height of the cataract from the river below to the edge of the basin. I could not take a barometer with me beyond my first station, on account of the difficulty of carrying it, and the chances of getting it broken, as well as the impossibility of suspending it amongst the rocks. I therefore had to take my Aneroid. We reached the barometrical station of the 16th, and continued on along the western side of the river, amongst enormous boulders of sandstone and conglomerate, amongst which grew shrubs, low trees, and agaves, all interlaced with tangled vines. Through these we had to search for an accessible track to pass along, and had to clear our way with a cutlass. As we approached the basin this growth gave way to a coarse moss growing on the soft earth, which covered the flat portions of the rocks, and which rendered the walking slippery and difficult.

Sometimes we were brought to a standstill by a perpendicular face of rock, and had to retrace our steps and try a new track; at others we had to pass through narrow subways, and under great rocks. It took us about an hour and a half to walk the distance, which I estimate at 350 yards in a straight line from the barometer station to the outer edge of the basin. As we approached it we felt the breeze coming outwards, and soon became enveloped in mist. At this point the Indian guide refused to go further, and then turned back. The sun cast its rays upon our backs, and produced small rainbows in front of our faces, which were most dazzling, and almost prevented our seeing the way in passing over deep fissures amongst the rocks. At the basin the mist and spray completely surrounded us, quite hiding the sun, like a dark cloud. Here we had to take shelter behind the rock, from the blinding storm of mist and rain which assailed us, driven outwards by the hurricane produced by the falling water, and through gaps witness the strange scene before us. The water in the basin most truly resembled a huge boiling caldron, to which I before likened it, being lashed into a fury of great irregular waves, whose crests were blown into spray; and as they drove outwards in an irregular semicircle, were dashed against the rocks in front and walls of the cave on either side, beating over one rock that I am sure was 15 feet high. The foot of the descending column of water was rendered indistinct by the mist, but great fleecy masses of white foam spurted upwards many yards high, in clouds mixed with spray and mist.

At the lower end of the smooth water below the fall, at a distance of three-quarters of a mile, there is a long sloping cataract, for which the Indians with me said they had no name. The roar of this cataract drowns that produced by the Great Fall, on account of its proximity to the path along which we went; so that the sound of Kaieteur can only be heard at a distance of half a mile from its foot.

Having taken all the necessary observations, and completed the work for which this journey had been undertaken, we determined to start upon our return journey on the following day.

I made inquiries about the upper Fall on the Potaro from some Indians who had just come down from it, and, from their description, it is a long sloping succession of cataracts, which taken together give a height almost as great as Kaieteur.

From similar inquiries, I learnt that the Fall on the Curiebrong fully realises all my expectations, it being, according to the Indian account, quite as high as Kaieteur, and also perpendicular. Its Indian name is Chowra-outa. Feeling satisfied as regards the truth

of this account, I think I may, without hesitation, lay claim to the discovery of the existence of this fall.

In giving an account of this fall, only a slight idea of its beauty, or of that of the scenery which surrounds it on all sides, can be conveyed. I will now give its actual dimensions, as I made them out, together with an outline of its geological structure.

Kaieteur Fall is produced by the Potaro River flowing over a sandstone and conglomerate table-land, into a deep valley below, with a total fall of 822 feet. For the first 741 feet the water falls as a perpendicular column into a basin below, from which it continues its downward course over a sloping cataract in front, 81 feet in height, and through the interstices of great blocks of rock, to the river-bed below. The head of the fall is 1130 feet above the level of the sea.

The vegetation about the immediate neighbourhood is very beautiful. All the surrounding country is covered with dense forests, with the exception of a small savanna close to the western side of the fall. On this savanna are scattered groves of low trees, with patches of grass, and bare stretches of level rock. The vegetation on this is very curious, there being numbers of small flowering grasses and rushes, while representatives of the Orchid family, of singular beauty, mosses and ferns, grow in great luxuriance over it. Amongst the Orchids are three species, which, I imagine, are quite unknown elsewhere. They grow on decayed wood lying on the rocks, have large roots, and grow very high. Their flowers are large, delicately scented, and in form resemble those of the *Catleya*.

A large species of Agave grows in great numbers here. Its leaves are more of a yellowish green colour, and their points are of a rounder form, than those of the *Agave vivipara*. Growing along the track from the landing to the foot, are great quantities of ferns and mosses, and on the rocks close to the edge of the basin are small scarlet bell-flowers, and a fine sack-shaped orchid. All the rocks near the basin are covered with a coarse moss, and beyond, on the rocks washed by the waves, this growth gives place to a small water-plant.

Small clusters of dark-green shrubs cling in patches to the lower portion of the precipice, on either side, and look like ivy on a castle wall. A long kind of grass grows in the water on the western edge of the lip.

The scenery of the great valley below, when viewed from near the head of the fall, is extremely fine. Late in the afternoon, when the sun is sinking in the west, great shadows are cast across it,

which have a magnificent effect; and the colouring is then very beautiful: the end of the valley being lit up by the golden reflection of the sky over the plain beyond, and the strips of river winding in the depths below, look like little bands of silver. Viewed from this spot, none of the bare precipices on the valley-sides are disclosed, but all appears to be covered with a rich dark green clothing of trees.

Mr. SAWKINS (Director of the Geological Survey of British Guiana) explained that the interesting discovery of the Kaieteur Waterfall had been made by his colleague, Mr. Brown, whilst descending the Potaro River. He had made a water-colour drawing of the fall, from a sketch by Mr. Brown: this he explained to the meeting. He also explained a series of other views taken in British Guiana, which he had sent for exhibition. One of the most striking was a magnificent view of the Roraima Mountain, or "Red Rock," in N. lat. 5° 9′ 40″, concerning which he said:—"This mountain is estimated at 7500 feet above the sea. Sir R. H. Schomburgk considered its length to be 3½ miles, but Mr. Brown (who drew the pencil-sketch from which this picture was made) estimated it as 18 miles. The only way he (Mr. Sawkins) could account for this difference was, that the points of observation were nearly at right angles of a parallelopiped. On account of its great elevation, compared with any other mountain in its vicinity, Roraima is seldom free from clouds, and becomes a centre of condensation. From its northern base a dense forest extends to the Atlantic, and from its southern base savannahs or prairies extend far into Brazil. A number of cascades fall from the summit during the rainy season, and by their flowing in different directions become tributaries of importance to three of the largest rivers of South America north of the equator, viz., the Amazon, Essequibo, and Orinoco. One of these cascades is called Kamaiba by the Indians, and estimated by Schomburgk to be 1500 feet high, falling into a spacious basin with a thundering noise. Mr. Brown's observations were made on the opposite side of the mountain, therefore he did not see 'Kamaiba.' The perpendicularity of the mural portion has prevented even the natives reaching the summit. The wall is estimated by Sir R. H. Schomburgk at 1500 feet above the vegetation that surrounds its base, but Mr. Brown considers it to be 2000 feet: this may arise from the different points of observation. The whole mountain is composed of sandstone of a light red tinge and a conglomerate formed of white quartz. It has been observed that a vertical wall of rock of 1600 feet has in vain been sought for in the Swiss Alps (Humboldt). Mr. Sawkins had seen nothing approaching this magnitude among sedimentary rocks, except in Mexico, on the highest part of the cordilleras between Durango and Mazatlan; and in Peru on the eastern slope of the Andes, descending to the great plateau of 'Junin' by the pass 'de la Viuda,' near one of the head sources of the Ucayali, a tributary of the Amazon, between 14,000 and 15,000 feet above the sea."

Mr. SAMUEL WOODS remarked that the paper which had been read appeared not to be the account of the original discovery of the falls, but an official report of a subsequent journey. The account of the first visit appeared in the Demerara papers, and was much more graphic as well as fuller of details regarding the size and nature of the falls. On the second occasion the water appeared to have very much subsided, and therefore the falls did not present anything like the same appearance of grandeur as on the first visit. Mr. Brown was then unable to reach the falls by the Potaro River itself, and ascended one of the tributary streams, proceeding thence across a considerable extent of country, so that he came out above the falls.

Mr. R. BROWN (the father of the author of the paper) also said that the first account was the more interesting, being written by his son evidently on the spur of the moment, when everything was fresh and new and strongly impressed upon his mind; but the second account was compiled more in his official capacity, so that he felt himself somewhat more under restraint than on the previous occasion.

Seventh Meeting, 27th February, 1871.

MAJOR-GENERAL SIR HENRY C. RAWLINSON, K.C.B., VICE-PRESIDENT, in the Chair.

PRESENTATIONS.—*Edward Langworthy, Esq.; the Venerable Archdeacon Bickersteth; Major W. M. Bell.*

ELECTIONS.—*Napoleon Argles, Esq.; the Venerable Archdeacon Bickersteth; Henry Cook, Esq.; Rev. Enos Couch; J. E. Edwards, Esq.; Francis Finch, Esq.; Thomas Greg, Esq.; Henry Head, Esq.; Henry Jackson, Esq.; Edward Langworthy, Esq.; John M. P. Montagu, Esq.; Robert Methven, Esq.; W. Richard Portal, Esq.; Rev. Henry Mould Robinson; Major Percival Swan; Thomas F. Septimus Wakley, Esq.*, C.E.; *Francisco Van Zeller, Esq.*

ACCESSIONS TO THE LIBRARY FROM 14TH FEBRUARY TO 27TH FEBRUARY.—'The Rajas of the Punjab.' By Lepel Griffin. Presented by the India Office. 'The Natural History of Hainan.' By R. Swinhoe, F.R.G.S., H. M.'s Consul. Donor the author. 'Von Tripolis nach Alexandrien' (Journeys in 1868 and 1869). By Gerhard Rohlfs. Donor the author. 'An Introduction to the Language and Literature of Madagascar.' By Rev. Julius Kessler. Donor the author. 'Narrative of an Ascent to the Summit of Mont Blanc in 1822.' By Fred Clissold, Esq. Donor S. Drach. 'The Natal Almanac and Directory for 1871.' Donor the publisher. 'Statistics of New Zealand for 1869.' Donor the Registrar-General.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING, FEBRUARY 13TH.—The Nolla-Thal, in the Canton of Grisons, Switzerland, on 3 sheets. Presented by Professor J. M. Ziegler. General Plan of a part of the Division of Queenstown (Cape Colony), on 5 sheets. By the Government Surveyor. Map of the Territory of the Chief Nicolas Waterboer, showing the boundary between Waterboer and the Cape Colony. By the Government Surveyor. Photograph of a Map showing the Island of Réunion. By J. Maillard. Presented by Rev. Julius Kessler. Sheet No. 19, Dijon; of the Government Map of France. Presented by the War Office.

The CHAIRMAN informed the meeting that Dr. Cheadle, well known as the

companion of Lord Milton in his journey across North America, had kindly undertaken to read the present paper, or rather extracts from it, accompanied with some observations of his own, which appeared necessary in order to render the subject more intelligible to the meeting.

The following paper was then read by Dr. Cheadle:—

1.—*On the "Benches," or Valley Terraces, of British Columbia.* By MATT. B. BEGBIE, Chief Justice of British Columbia.

THE paper was described by Dr. Cheadle as being a report compiled by Mr. Chief Justice Begbie, at the request of the Governor of British Columbia, in answer to questions put by the Rev. W. Robinson, of Cambridge, and transmitted through the Colonial Minister. The extracts from the report read by Dr. Cheadle were as follow:—

I have received and perused the despatch from the Secretary of State to yourself, dated the 21st June, ult., enclosing a letter from the Reverend William Robinson, dated 13th June, 1870, to which you wish me to reply.

I regret very much that I am ignorant of all save the first principles of geology, in fact of all except some quasi-technical expressions which everybody knows by rote, and which probably every unscientific person must use inaccurately. But at your request I will state as well as I can what I have seen.

The benches in question are so curious that they must immediately attract the attention of the most unobservant. Accordingly I took occasion to remark upon them in a report of my first circuit in British Columbia (in March and April, 1859), addressed to Governor Douglas. It will be seen there that I attributed the "benches" to the same origin as the "mountain roads" of Glen Roy, to which Mr. Robinson refers. But the plateaux on Fraser River being often much interrupted, they in many places far more nearly resemble in appearance the plateaux which were the scene of the battle of Rivoli, mountains, river, and all; the Fraser River is, however, a much stronger river than the Adige.

In 1859 I had only seen the "benches" on Fraser River or its immediate vicinity up to a distance of fourteen or fifteen miles above Lilloett. Subsequent observations, and a further acquaintance with the country, do not induce me to change the opinions expressed in the above mentioned report, though some of the details are very inaccurate.

It was perhaps scarcely possible for any person who has never seen Fraser River, or obtained an accurate description of it, if any verbal description can be accurate, to form an idea of its banks.

Being informed that this bench formation uniformly, *i.e.* everywhere, extended from a point below Lytton to some point above Lilloett, Mr. Robinson might naturally conceive that the formation extended uniformly, that is, regularly, and so might ask his third question, viz. whether the bench at Lytton rises or falls as you travel up the stream, and whether it finally dies out at Lilloett.

The distance from Lytton to Lilloett is 43 to 45 miles, and this may seem a considerable extent of bench formation when compared with Glen Roy, which extends but 20 miles. But the bench formation in British Columbia extends the whole distance of Fraser River so soon as the delta is left, as far as I have travelled up it, *i.e.* full 400 miles, and then the benches are seen running on, miles ahead. Wherever the formation has a chance of showing itself from Hope upwards, *i.e.* wherever it is not interrupted by precipices, or chasms, or denudations, there are benches more or less clear and regular. Up the Quesnelle River, and on Cottonwood, an affluent of Fraser River next above Quesnelle, and Lightning, affluent of Cottonwood, up to within 25 miles of the Bald Mountain, the backbone of the Cariboo range, I still found exactly similar benches. The formation extends all up Thomson River, far above Kamloops, along both forks, as far as I could see. There are several well defined terraces on the Okanagan; in particular on the "Rivière du Sable," halfway down the lake, mounds like truncated pyramids, or rather a pile of four or five truncated sections of pyramids. On the only portion of the Columbia River which I have travelled, viz. Fort Shepherd to Fort Colville, the formation is just as distinct and striking as on Fraser River, and I am informed and fully believe that it is quite uninterrupted down to Snake River, in lat. 46°. The largest benches, both in length and breadth, that I have seen are in the valley of the Upper Kootenay River, about long. 115° 30′ w. (Lilloett being 122° w.). At Rock Creek, and all along Kettle River, the trails run for miles and miles along just such benches, and so too all along the Similkameen River and the Nicola River, not only at its influx into the Thomson, where there are six or eight heaped one upon top of another, but all along its course to the Nicola Lake. In fact, it may be said that everywhere in the Colony on the *east* side of Fraser River, wherever there is a river of any size, and the hills or mountains are near, but not too near, you find yourself on one of these benches, more or less regularly formed, but even when externally irregular, bearing traces of original regularity.

Just the same appearances are presented on the only parts west of Fraser River over which I have travelled, viz., along what was

called the Douglas road, now abandoned, starting from the head of Harrison Lake along the Lillooett River, and reaching Lillooett Flat (town site) on Fraser by a beautiful pass upwards of 100 miles in length, separated from Fraser by peaked mountains of considerable height, 4000 to 7000 or 8000 feet. But it is reported to me that similar level benches compared to those at Lillooett exist on the upper waters of the Skeena and other rivers at the northern extremity of the colony.

In Vancouver Island, the only instance of bench formation, of which I am aware is at the gold-diggings, near Sooke, about 20 miles from Victoria, where there are a few miles of benches, in, I think, two or three terraces. So far as I know, these are, however, quite isolated. The bed-rock in this part of Vancouver Island is generally trappeous, often granite, generally full of quartz veins, slightly auriferous, much rounded, and in many places, where exposed, smoothed and grooved in the manner which, I believe, is usually attributed to the action of heavy ice, or glaciers. There is, so far as I can see, very little or no difference in the materials or derivation in any of these benches, scattered as they are over this enormous territory, and at all sorts of heights above the sea-level up to 2500 or 3000 feet, which must be the least height of the benches on Lightning Creek.

But though the whole extent of the formation be vastly greater than at Glen Roy, the Scotch parallel terraces are far longer than any pair of corresponding benches which I recollect here. Until the tamer part of the river is reached, near Alexandria, it is rare to meet with a bench on Fraser River which extends a mile along the stream; while the intricacy of their outline is such that it is very difficult, without actual inspection, or a very good model, which would be both difficult and expensive, to form anything like a correct idea of the formation. A good photograph would be useful, but I cannot find one that has been taken with the slightest reference to these benches, so as to show their number, height, and correspondence on opposite sides of the valley. The formation of all these benches, and the materials of which they are composed are, as above stated, nearly everywhere very similar. It is like what I understand by the term "northern drift;" fine loam at the top, sometimes with an undue proportion of sand, coarser gravel beneath, mixed with water-worn pebbles, some of which (on Fraser and Thomson chiefly) attain almost to the dignity of boulders. Stones from 100 lbs. to 1 ton weight I should say are not uncommon on these two rivers. These are generally of granite, or of a metamorphic slate, sometimes volcanic, a few quartz; all very much

waterworn. The benches present every variety of elevation, one above another, from 3 feet to 300 feet. Ample, and too painful, opportunity is afforded the traveller for examining their materials, stratification, and thickness in sections of these benches, as the trail continually ascends and descends the too frequent gullies and chasms, formed some by the rush of the melted snows in early summer; scooped out, however, probably in many cases by much more abnormal and potent cataclysms, the bursting of some lake in recent times. The stratification appears to have been in some cases horizontal, in others in great whirls, always as if taking place in water, at rest or in motion.

On the other hand, if at Glen Roy there are but two or three benches 20 miles long—and the benches here are but a mile or two in length in general—there are in British Columbia not two or three, but an infinite multitude of such benches scattered over a tract certainly more than 100,000 square miles in extent. Almost in every case where benches occur, there are one or more—occasionally ten or a dozen—between the rivers and the base of the nearest hill; and similar benches, similarly irregular in number, on the opposite side of the river, one, or more, of which is almost certain to correspond in level with one, or more, on the spectator's side. But the changes on the river-banks are so frequent from the violence, and often the very sudden changes of violence, of the streams, from the frequent land-slips, and, in my opinion, from the gentle but continued upheaval or depression of the surface, that the corresponding bench on the opposite side of the river is often found to be wanting: sometimes many benches seem to have been swept away at once.

I have everywhere noticed that the highest benches are near the highest mountains and the most violent streams, in positions where the effect of some subsequent flood would be most likely to obliterate all traces of its predecessor, or else where volcanic agency is not disguised. But, generally speaking, on the Upper Fraser, where the stream runs less violently, and where there are only hills, no mountains—and those generally at some little distance from the river—the benches are more regular, and vary only by a few feet in level.

Wherever two benches meet, with rare exceptions, they are sharply defined by a bank or cliff at an angle of 45°, exactly similar to that by which the lowest bench falls on the river or lake which bounds it, and apparently formed in the same way, *i.e.* by the action of water alongside.

The benches are to all appearance in their normal state, level in

the direction of the neighbouring stream. But I suspect that they follow its general inclination—it might be said, incline "conformably" with the stream, as a general rule. For instance, it is very common for ditches—which, of course, always have some fall, though their fall varies extremely from an inch in a mile to an inch or more in a yard—to be carried along a bench in the direction of the principal stream, very rarely against that direction, and only when the supply is taken from a side creek, when, of course, the ditch may be taken in any direction. This question could not be determined without levelling a good many benches carefully. I should not be disposed to place much reliance on a barometer for such minute differences of level, and any hypsometer I have seen would be useless. But as to the transverse inclination (*i.e.* in the direction at right angles to that inquired of by Mr. Robinson), a great many benches, especially as they recede from the river, have a very decided inclination, *i.e.* they slope from the mountain towards the stream, and sometimes very rapidly, as if an upheaving force had burst through a slightly flexible stratum of drift, and raised it to the highest point just before it finally emerged. Nevertheless, the benches sometimes slope the reverse way; so that I know two or three instances of benches where lakes are formed next to the mountain base, the bench presenting an appearance similar to the "lip" on rivers running through alluvial flats, but which appearance is, I think, due to quite a different cause from the "lip," viz., to a local depression having taken place after the formation of the bench.

Having made these very imperfect preliminary remarks, I shall now consider the questions put by Mr. Robinson. I fear I cannot give a categorical answer to them, chiefly owing to my own ignorance, from not having paid sufficient attention to the points inquired into; but partly, perhaps, because Mr. Robinson appears not to have conceived these benches as they really are.

Taking, then, the first and third questions in connection with each other, viz.—First, "How many terraces or benches are there at Lytton? On which of them does Lytton stand, and what are their heights above each other?" Third, "Does the terrace on which Lytton stands come nearer the river as you ascend the river, and so die out about Lilloett?"

These questions seem to indicate the idea of one continuous terrace, if not several, running all the way from Lytton to Lilloett, about 43 miles. But there is one large river—the Thomson—immediately above Lytton; so that the flat is perhaps not more than half a mile long. There are many creeks and points of bed-rock,

and innumerable gullies, before you reach Lilloett; and it would appear to the traveller almost as if every river, creek, and point of rock and gully completely changed the system of benches. For 40 miles above Lytton the terraces are, at least on the east bank, more broken up and disorderly than in any part of the course of the river.

My impression is that all these three flats slope, but very slightly, in the general direction of the Thomson and Fraser. I am sure that the upper plateau does. The slope is considerable enough to be noticed in riding to or from the town. Within a quarter of a mile to the south of the town a deep and steep gully occurs; and there is no flat apparently corresponding to the three thus isolated, either on the south of the gully, or on the west bank of the Fraser, or north bank of the Thomson River. The Lytton group, like fifty other groups within 50 miles, seems to stand alone.

Just before reaching Lilloett, however, the benches become exceedingly striking. Speaking from memory, I should say there were at least five or six different benches, apparently as level, green, and well defined as billiard tables, on the east bank, and a still greater number on the west bank, or Lilloett side, where they are intersected in a most picturesque way by the brilliant N'Koomptch, running through the magnificent gorge leading from Seton Lake, about 3 miles from the Fraser, the northern extremity of the Douglas trail already referred to.

Here I may as well state and answer Mr. Robinson's second question: "How many terraces are there at Lilloett? On which of them does Lilloett stand? and what are their heights above one another?"

There are, I should say, speaking from memory, at and in sight of Lilloett, at least 15 or 16 benches on both sides at various levels, some three or four on each side of Fraser River exactly corresponding in level: but many on either side of the river having no apparently exact counterpart on the other bank. Lilloett stands on a plateau, which I judge to be about 160 feet above high-water mark of Fraser River, varying between March and June 30 to 40 feet vertical. This plateau at one place goes right down to the river by the usual steep bank or cliff (angle of 45°), but in other places it connects with other plateaux; so that you may, if you please, make one abrupt descent, or two, or three, or even four, to reach the Fraser. I have never been on the highest bench in this neighbourhood, which I should say is on the east side, and which I should judge to be 500 or 600 feet above the Fraser. The benches next the Fraser are apparently very nearly or perfectly

level. Next the mountains—from base to base of mountain, 1 mile to 3 miles—the benches slope very much, as if upheaved by and shouldered off from the mountain in its gradual elevation.

The different benches at and about Lilloett vary very much in their elevations above each other, from two or three feet to 60 or 80 feet or more. They are generally from a quarter of a mile to a mile or two in length—one perhaps may be two miles and a half (next Fraser River), east bank, below and opposite to Lilloett.

Mr. Robinson's fourth question is—"I believe there are at least three benches at Alexandria, and that the fort stands on the lowest, 50 feet above the stream and 1470 feet above sea-level. How many terraces are there at Alexandria, and how far are they above each other? I am particularly desirous of ascertaining the height of the topmost."

There are, I should think, on the fort side (west bank of the river) at least twelve or fifteen terraces immediately at Alexandria; and from their regularity and contiguity—being generally narrow, and only a few feet differing in height—present a very singular and striking appearance: like a gigantic flight of steps ascending the hillside gradually.

The present fort stands on the west bank (where the benches are more numerous than on the east bank), on the lowest bench, not, I should say, above ten feet above high-water mark. The Fraser here rises perhaps 25 feet vertical. The fort of ten years ago, to which Mr. Robinson probably refers, now nearly pulled down, stood on a higher bench, I think the third, about 40 or 50 feet above high-water mark perhaps, but I should guess from memory not above 30 feet. As to the 1470 feet above sea-level, that is probably within a few hundred feet of the truth. I mean I should place the level at from 1400 to 1900 feet. The terraces opposite to Fort Alexandria, though less numerous, are perhaps more extensive both in length and breadth, apparently perfectly level, though out of the upper bench, about half a mile below and opposite to the fort, there rises a very beautiful instance of basaltic columns, about the dimensions of those at Staffa; no cave, however, but a bold front facing to the south-west, and about 200 yards from north to south—40 or 50 feet high, speaking from memory. At their foot, that is, on the south-west front, there is a mass of débris, and the plain seems slightly upheaved for 100 yards or so. The top of the columns is crowned with a similar sort of mould and vegetation to that at their foot.

It may not be out of place to state one or two instances which have induced me to think that changes of level are now going on in a gradual way in, at all events, some parts of the colony. At a

point near Fraser River, about thirteen miles south of Quesnelle, and again in a more conspicuous, and, indeed, a wonderful, instance on Hat Creek, an affluent of Buonaparte River close to the entrance of the Marble Cañon, I have noticed beaver-dams on a slant, abandoned dams, of course. A beaver-dam, I need not say, is a beautiful piece of engineering, constructed entirely of branches and earth, never known to give way, never built on a stream that runs dry in summer, and, of course, as level as the surface of the water it is built to retain. On Hat Creek, at the point in question, there must have been a large colony, for the dams extend in various directions for an aggregate length of very many hundreds of yards.

I should think that any violent commotion would have greatly disturbed such dams; but these were all quite perfect, though on a slant probably of one in ten, there was no longer any water running, or any retained on the surface; though there were indications of water at no great depth. The old watercourse was quite visible. Many of the animals' favourite cotton-wood trees were growing there, perhaps thirty years old, but no sign of any living beaver. There were many old cotton-wood stumps, but they were very old, and a fire had been over the ground, so I could not decide whether these trees had been felled by beaver or otherwise.

From the similarity of soil, formation, &c., the theory might well be ventilated that all the country east of the Fraser, and a large tract on the west bank, has been at some distant geological period the bed of a vast lake or series of lakes considerably larger than that existing from Lake Superior to Lake Ontario; and that various ridges of hills and mountains have been, either together or separately, but at many distant periods of elevation, gradually protruded under and through this bed, laying it at last completely dry, and indeed at a very considerable elevation above the sea-level: upheaving a large mass of the continent, viz. at least from Fort George, near the 54th parallel to Snake River, 46° N., and from near Bentinck Arm, in 127° W., to Wild Horse Creek, in 115° 30′ W.; and laying bare vast valleys of denudation, such as are to be seen not only in the Fraser, Thomson, Columbia River, &c., valleys, but in the valleys of much smaller streams. Hat Creek, Alkali Creek, Canoe Creek, &c., now run at the bottom of very deep basins, vastly larger than can be apparently referred to the erosive power of the present insignificant streamlets, none of which are larger than the water of Leith, near Edinburgh; and many run in valleys, with walls of solid rock half filled with débris similar in material to the benches, and apparently water-worn on the surface universally. These

valleys are from one to five miles in width, and 700 or 800, sometimes, as Canoe Creek, 1200 feet deep by my measurement. The surface is scored and grooved in every direction by the action of great whirls and torrents, but mainly as if vast quantities of oozey mud and débris had been pushed down into the valley from the side hills. In many places I have noticed very curious little conical hillocks, just like the peaks of volcanoes, but formed of the same aquatic gravel and loam. In two or three I have found a sort of core of bed rock, and it seemed as if their formation was due to this latter arresting the lacustrine deposit, and these may thus have been formed into a cone by the whirl of eddies or by the effect of gravity, as may be seen any day by tilting over a cart of gravel on a small boulder.

There is yet one other phenomenon to which I have alluded, which occurs frequently in British Columbia, as might be expected from the steepness of its mountain sides, the nature of the bench formation which adheres to them, and the vast quantity of snow and rain which falls in so mountainous a country—viz., landslips.

Three, at least, of these have within the memory of man fallen into the Fraser, and nearly dammed up, however temporarily, that enormous river, viz., one about 12 miles above Lytton, the ruins of which still remain, one about 10 miles above Lilloett, and one two or three miles below the present Fort Alexandria, which caused a flood sweeping away the old fort with all its contents, and causing the loss of many of the Hudson Bay Company's employés there. The fort was thereupon established on the bench referred to by Mr. Robinson. There are several "dry" landslips, if I may so term them; of these two or three examples may be seen near Soda Creek, one of which is about one mile long and half a mile wide. Other beautiful examples may be seen in the Pavillon Creek, nearly 21 miles from Lilloett, on Thomson River, 15 miles from Lytton, on Bridge River, &c. Some of these are several miles in length, and must include thousands of acres. In most of them trees growing at the time of the slip are still growing on the displaced mass, leaning at every angle with the horizon.

In some the bench seems to have gone down sheer, bearing with it, unharmed, all that was growing on it, and leaving a perpendicular cliff. In some, the displaced surface seems to have moved painfully and grindingly over the subjacent bed-rock, and the surface is broken into a thousand irregularities; at Pavillon, and on Thomson, the mass looks not unlike an earthern "glacier du Rhin."

Dr. CHEADLE made the following observations on the paper:—The benches, or terraces of British Columbia are levels or ledges found on the side of the valleys

of the Thomson and Fraser, two of the principal rivers in the country, and also in the valley of the Columbia River. They are found all along the valleys, from the mouth to very nearly the sources of the rivers, and at different levels, —the terrace on one side corresponding with that on the other. This is not, however, always the case, for here and there one of the pair of terraces has been washed away. As you may well imagine, where the stream has risen unusually high, or a landslip has occurred, a terrace may have been carried away on one side or the other. These terraces give a most peculiar character to the scenery. It is said that Nature abhors a straight line, but here you have nothing but straight lines. Instead of the ordinary undulations met with at the bottom of a valley, or simply an alluvial flat, you have a succession of terraces rising one above the other. In travelling up the river you go along one of these terraces for a certain distance, then suddenly you are brought up by a sloping bank like the face of a railway embankment; you ascend it, and find yourself upon another level plain; you go on for a certain distance, and you come to a similar embankment, and so it is throughout. These terraces have been observed on other rivers; and they are, perhaps, more numerous and extensive on the Columbia River than on the Fraser and Thomson. Similar terraces are not unknown also in other parts of the world. They have been noticed, I believe, in some of the valleys of the Himalayas, and have been described by Dr. Hooker. The parallel roads of Glen Roy in Scotland are well known; and similar benches have, I believe, been seen on some of the rivers of Patagonia. Nowhere, however, are they so numerous, so striking, or prolonged over so extensive a district, as in British Columbia and Washington Territory. They are found over the whole watershed of the Fraser, Thomson, and Columbia,—an extent of country amounting to about 200,000 or 300,000 square miles. The others are merely isolated cases in comparison. The character of the country where these terraces occur is very striking. After traversing the central plains of the North American continent from east to west, and surmounting the steep ridges of the Rocky Mountains, you find, instead of a corresponding plain on the western side, that you are still amongst mountains. The view from the western slope of the main chain over British Columbia is one of the most magnificent, perhaps, in the world. In every direction, as far as the eye can reach, extending apparently to the ocean, nothing but a closely packed mass of mountains is visible; many of them the loftiest snow-clad peaks, and separated only by the narrowest valleys. Washington Territory, which is drained by the Columbia, is less mountainous, but is still intersected here and there by great mountain-ranges.

The nature of the material of which these benches are made, their uniform level, and the straight lines, all prove satisfactorily that they are water formations; and their being found only on the river valleys, and disappearing as soon as you pass through the estuaries, proves that they were formed by the action of *fresh* water. It is a matter of extreme interest, and there has been much speculation, as to how these terraces have been formed. They have been formed by water, but in what way? Do they bear any relation to one another? Are the terraces in Scotland and India and British Columbia all parts of a system resulting from a common cause, or do they depend on local causes?

Mr. Gibbs, geologist to the United States exploring expedition 1853-4, observed these terraces on the Columbia River, and gave an accurate and careful description of them, arriving at the same conclusion as Mr. Begbie, that they are water formations, the relics of extinct lakes. But it seems to me that Mr. Begbie's explanation of this drainage having been effected by the gradual upheaval of the mountains through the river-beds is hardly sufficient; for I think, if that were so, we should have one level flat representing the original bed of the lake, and no terraces of successive elevation. The suc-

cession of terraces, one above the other, seems rather to prove there was a succession of drainings,—that the lake was drained off to a certain level, at which the water remained for a time; after that to a still lower level, at which the water again remained for a time, and then there was a further letting off of the water, and in this way each successive pair of terraces was formed. How this occurred will be better understood, perhaps, if I just sketch to you the formation of the country in which these terraces are found. They are met with, as I said, in the basins of three rivers: the Fraser, the Thomson, which is an affluent of the Fraser, and the Columbia and its tributaries. Now these rivers, the Fraser and Thomson, are surrounded, you may say, on all sides by lofty mountains, or by extremely high land—they form, in fact, central basins; and not only are they walled in on every side landward, but their exit to the sea is barred across by a great range of mountains, called the Cascade Range, so that they have to burst through that barrier to escape into the ocean. Exactly the same thing is the case with the Columbia River, which is surrounded on all sides by mountains of great elevation, which dam the water in every direction; and, like that of the Fraser, it would be prevented by the Cascade Range from reaching the sea, but for a rent through which it passes. Thus in all these cases you have a central basin surrounded by lofty mountain walls. The passage by which these rivers escape to the sea is exceedingly narrow; so that the Fraser, which some 200 miles from its mouth is as broad as the Thames at Richmond, is only a stone's throw across where it passes through the narrow chasm near its mouth. It is obvious that a slight geological change would completely dam up this river. An obstruction at any part along the chasm would flood the country over an immense district above. Exactly the same holds with regard to the Columbia. A very slight amount of obstruction there—a landslip—would completely dam up the river, and stop its exit into the sea. And this is the case not only near the mouth, but also at numerous places up the river where it passes through similar narrow gorges, so that at many points for several hundred miles above the mouth of the Columbia, I imagine, and all the way up the Fraser, a succession of lakes might easily be formed by any accident occurring to obstruct the stream lower down. Now, if we suppose that the converse of this were the case,—that these lakes existed, the waters being held back by dams at certain points,—it is clear that on the giving way of these barriers, the water would be drained off, and the bed of the lake be laid dry. I have shown how very easily an accident such as the damming up of the stream might occur, and it is curious that Mr. Begbie mentions three instances in which this has partially taken place by landslips. Dr. Hector also, who visited that country, relates another instance in which the same thing apparently occurred on the Columbia. He mentions that the Columbia River for 30 or 40 miles flows almost without current, and that an Indian tradition stated that at that part it was formerly extremely rapid and of uniform swiftness, and that it ran under a gigantic arch of rock; but an earthquake took place, the arch fell in, damming up the stream, and the country was flooded. It does not require any great stretch of the imagination to see how the converse might occur, and instances of this are also recorded. Mr. Gibbs, of the United States survey, points out two or three places along the Columbia River where, in his opinion, such barriers had undoubtedly existed; and he mentions, in particular, one instance in which huge masses of rock had been displaced by the force of the stream, and carried a short distance down. These masses of rock had evidently not come from far, for the strata just above had been disrupted, and the rocks were not in any degree water-worn. It is possible that these barriers may have been broken through, not necessarily by any general convulsion, but by the erosion of rivers weakening them; or it might be that the continual upheaval of the continent has gradually weakened them so much, or displaced them so much,

that at last they have given way, and the water has escaped. I think we must suppose that a number of such accidents have taken place, because there are so many successive terraces. The terraces on the Lightning were nearly 3000 feet above the level of the sea, on the Kootenay 2600 feet; the top bench at Lytton only 800 feet; while the top bench at Lilloett is from 1300 feet to 1400 feet. The lowest bench at Alexandria, higher up the stream, is from 1400 feet to 1900 feet: so that it appears not only must there have been several accidents by which the water was drained off at different periods, but there must have been several different barriers.

The Rev. W. ROBINSON said that the well known terraces in and about Glen Roy were horizontal, and of the same altitude on the two sides of the streams. There had evidently been no elevation or depression of the region since their formation. We were, therefore, driven to the conclusion, that they were formed by water standing at their height. The water might possibly have been higher than the topmost terrace, but at least it has been as high; that is, between 1100 and 1200 feet above the present sea-level. By some means, the barrier that held in the water at that height gave way, so far as to let it down to the level of the second terrace; and, again, after an interval, to the level of the third terrace. The one point, however, on which he aimed to fix attention, was the existence of that great body of deep water where now is dry land. It was that fact that awakened curiosity to know whether the British Columbian terraces were similar to the Scotch. He wished distinctly to recal one sentence of Mr. Begbie's communication,—"From the similarity of soil, formation, &c., the theory might well be ventilated that all the country east of the Fraser, and a large tract on the west bank, has been at some distant geological period the bed of a vast lake." This intelligent gentleman then traversed that extensive region, with its valleys from 1 to 5 miles in breadth, and from 700 to 1200 feet deep; and the phenomena he witnessed suggested to him the presence there, at some past time, of a deep lake or sea,—a collection of water like that which certainly existed formerly in Scotland, but on a far larger scale. No one had given such laborious attention to terraces as Mr. Robert Chambers. The fruits of his investigations were before us in his work on ancient sea-margins,—a work containing descriptions of terraces in Scotland, Ireland, England, France, Switzerland, Scandinavia, and North America. Naturally his attention was much directed to Great Britain; with what result? He did not suggest as a theory which may deserve to be ventilated, but as a conclusion about which he had no doubt, that the sea formerly stood at least from 1200 to 1500 feet above its present level. Of course, under such conditions, what is now called Great Britain would be an archipelago. Again, Sir, then, we find terraces yielding to a very sagacious observer the inference of a high-water level. The same distinguished man investigated the terraces of North America, and drew the same inferences from them; viz., that they originated in a sea-level much higher than that now existing. Connected, then, with terraces, four points are before us. (1.) The certain existence at a recent geological period of a large body of deep water in and about Glen Roy; large, because the terrace system there runs about 20 miles from east to west, and 12 from north to south. (2.) The terraces of British Columbia induce Mr. Begbie to throw out the hypothesis of a vastly larger body of deep water there. (3.) The same conclusion reached respecting England, by our most practised investigator. (4.) The same conclusion reached by him respecting North America. Now, if these terraces had been rightly read, we could scarcely avoid a wider hypothesis, which should connect and comprise the four already named, and which might be best given in the words of Robert Chambers,—"There is enough to justify a question regarding uniformity of level, not only throughout North America, but (bold as the idea may in the present state of knowledge and of hypothesis appear)

between the old and new continents;" so that he was led by his study of the terraces to conceive of a sea-level common to Europe and North America, and at least between 1000 and 2000 feet above the present level.

Mr. Robinson proceeded to suggest that the water of the world has been more than once rolled from one hemisphere into the other, and that in the post-tertiary times it was all north of the equator. As showing how that might be, he referred to a paper in the 'Journal of the Royal Geological Society of Ireland,' vol. i. part 3, p. 288, and to a letter in the 'Athenæum' of October 19, 1867; and argued that nothing but such a high water-level would account for the terraces of the world, the former state of the Arctic regions, the prodigious amount of drift distributed in one general direction from the extreme north far towards the south pole, and other geological phenomena.

Mr. Dallas said he had travelled over a great deal of the country described by Dr. Cheadle, and had come to the conclusion that the terraces could have been formed only in one of two ways,—either by the hand of man, or by natural causes. Of course they were not made by man, and therefore the only hypothesis left was that they were caused by water. He agreed with Dr. Cheadle in thinking that they must have been formed by the draining off of the water at various epochs, though it was difficult to say what was the precise cause of the sudden drainage. It might have been by subsidence of the earth, by overflow, or by the water gradually percolating through, and at last forming a channel for itself. He did not think that the formation of the terraces in British Columbia and Washington Territory had any necessary connection at all with that of the terraces in Scotland and other parts of the world, because there were very simple explanations why they should exist in some parts of the world and not in others. The chain of the Rocky Mountains runs from north-west to south-east, and forms a barrier across the country. Between that and the Cascade Range, which runs nearly parallel to it, there must have always existed, as there does now, a large basin; and it was easy to imagine that that basin had been filled with water, though not necessarily at one level—the intervening country between the two main ranges being, in fact, a net-work of mountains. The accumulated waters of the various basins, in forcing a passage by the channels of the Columbia, the Fraser, and other minor streams, might have formed the successive terraces at various periods in each district of country; and he maintained that no real ground existed for attributing the fresh-water terraces of the old and new continents to one simultaneous cause. So far as his observation extended, the terraces were a true level, and had no slope with the rivers.

Mr. Woods asked whether the surface of the terraces and their bases were formed of the same material, or whether there was any marked difference.

Dr. Rae said when he visited British Columbia he was on a telegraph survey, and could not wait to take any measurements of the terraces; but it struck him very forcibly that, instead of being horizontal, they sloped with the river-bed. If such were the fact, it would upset the theory of a large inland lake.

Dr. Cheadle said it was clear that the terraces were not formed by sea water, but by fresh water, for they are found only in the river valleys, and not on the coast; they entirely cease after the rivers pass the Cascade ranges. He agreed with Mr. Dallas in thinking that the whole of the interior basin of British Columbia had been pretty well filled with water, by a number of lakes at different levels very like the present lakes of Canada. The barriers damming up those lakes had been broken through, and the waters drained off. The upper stratum of the benches is of the same material as the lower stratum, with this exception, that the coarser and heavier material has sunk to the bottom, so that there is tolerably fine sand at the top. Nothing but careful observation could settle the question as to whether the terraces were perfectly horizontal or sloped with the river.

Eighth Meeting, 13th March, 1871.

MAJOR-GENERAL SIR HENRY C. RAWLINSON, K.C.B., VICE-PRESIDENT, in the Chair.

PRESENTATION.—*W. R. Portal, Esq.*

ELECTIONS.—*Sir James Anderson; W. Blackmore, Esq.; Richard Belgrave Jackson* (late H.M. Consul at Foochowfoo); *Sir Donald F. McLeod*, K.C.S.I., C.B.; *Captain James Nicol; G. Wm. Petter, Esq.*

ACCESSIONS TO THE LIBRARY FROM FEBRUARY 27TH TO MARCH 13TH. —'Annalen der Sternwarte in Leyden,' herausgegeben von D. F. Kaiser. Haag. Presented by the Director. 'Palestine Exploration Fund.' Quarterly Statement. N.S., No. 1. Presented by the Committee. 'A Thousand Miles in the *Rob Roy* Canoe.' By J. Macgregor. Presented by the author. 'The Voyage Alone in the Yawl *Rob Roy*.' By J. Macgregor. Presented by the author. 'The *Rob Roy* on the Baltic.' By J. Macgregor. Presented by the author. 'On the Chinese Dialect of Hainan.' By R. Swinhoe, H.B.M. Consul at Taiwan. Presented by the author. Forty Volumes of 'Sailing Directions' and Works on Navigation. Published by the Hydrographical Office of the Admiralty, and presented by the Hydrographer. 'Journal Asiatique.' Mai et Juin, 1870, and Periodicals to date. Paris.

The following works were presented by the Hydrographer to the Admiralty:—'The Channel Pilot.' Pt. I. 1869. 'The North Sea Pilot.' Pt. II. 1868. Ditto, ditto. Pt. III. 1869. 'The Channel Islands Pilot.' 1870. 'Sailing Directions for West Coast of Scotland.' Pt. I. 1867. 'Sailing Directions for Coast of Ireland.' Pt. I. 1866. Ditto. Pt. II. 1868. 'Views in the Baltic.' 1854. 'The Bothnia Pilot.' 1856. 'Sailing Directions: Ushant to Gibraltar.' 1867. 'España Maritima.' Vol. II. 1814. 'Sailing Directions: Candia or Crete.' 1866. 'Hydrographic Notice: Newfoundland, East and West Coasts.' 1868. 'Sailing Directions: South-East Coast, Nova Scotia.' 1867. 'The West India Pilot.' Vol. II. 1866. 'The South America Pilot.' Pt. II. 1865. 'The Vancouver Island Pilot.' 1864. 'The African Pilot.' Pt. II. 1868. 'The African Pilot: S. and E. Coasts.' 1865. 'The China Sea Directory.' Vol. I. 1867. Ditto, ditto. Vol. II. 1868. 'The Australia Directory.' Vol. I. 1868. Ditto, ditto. Vol. II. 1869. 'Australian Views: N.E. Coast.' 'A Method for finding the Latitude by simultaneous Altitudes of Two Stars.' By J. Bardwood. 1869. 'Tables for the Reduction of Meridian Altitudes.' By

J. T. Towson, F.R.G.S. 1862. 'Tables to facilitate Great Circle Sailing.' By J. T. Towson. 1861. 'Sun's True Bearing.' By J. Burdwood. 1869. 'Rules for Finding Heights and Distances at Sea.' By Lieut. H. Raper. 1866. 'Practical Rules for applying Deviations of Compass caused by the Iron in a Ship.' 1868. 'Admiralty Manual: Deviations of the Compass.' 'Admiralty Lists of Lights:'—1. W.S. and S.E. Coasts of Africa; 2. Coasts and Lakes of British North America; 3. The United States of America; 4. South America and Western North America; 5. The North Sea, Baltic and White Sea; 6. South Africa, East Indies, China, Japan, Australia, Tasmania, and New Zealand; 7. The Mediterranean, Black, and Azof Seas; 8. The West India Islands, &c. All corrected to Jan., 1871. 'General Instructions for the Hydrographic Surveyors of the Admiralty.' 1832.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING OF FEBRUARY 27th.—Map of a portion of Eastern Turkestan, to illustrate the Expedition to Yarkand in 1870. By T. D. Forsyth, Esq., C.B. Presented by the author. Plan of Yarkand and of Yangi-Shahr, or New Town. Presented by T. D. Forsyth, Esq., C.B. A Bust of Charles Dickens. By W. F. Woodington, Esq. Exhibited by the author.

The following paper was read:—

Mr. Thomas Baines's Exploration of the Gold Region between the Limpopo and Zambesi Rivers. Compiled from his Journals by ROBERT JAMES MANN, M.D., F.R.G.S.

THE exploration described in this communication resulted from an endeavour made by a company of gentlemen in London to get the geographical and mineralogical character of this district settled by a careful and formal examination. The expedition was placed under the charge of the well-known South African traveller and artist, Mr. Thomas Baines, with Mr. Nelson, a well qualified mineralogist, for his associate, and he had most judiciously and admirably accomplished the task entrusted to him. The communication was drawn up from Mr. Baines's very voluminous Journals sent home from time to time.

The expedition left England on the 19th of December, 1868, and passed through the colony of Natal in the month of February following. It next passed through the Orange River Sovereignty and the Transvaal Republic, and, crossing the Marico River near its confluence with the Limpopo, outflanked the main channel of that stream, and ascended the chief ridge of watershed lying between

it and the Zambesi River, until the 17° 30′ parallel of s. lat. was reached, a little to the west of the 30th meridian of E. long., within 120 geographical miles of the Zambesi River, on the 3rd of September, 1869.

Dr. Mann gave a sketch of the geography of this region, from the Orange River to the Zambesi, to illustrate the exceptional configuration of the great line of watershed lying between the Limpopo and Zambesi rivers. The Limpopo is here pushed up into a vast loop by the Drakenberg Mountains, and a broad gap then occurs, before these mountains are continued through to the mountains of Lake Nyassa, and beyond to the northwards. Throughout this range the water-parting is within 150 miles of the Indian Ocean; but from the 22nd parallel of s. lat., for some 360 geographical miles of breadth, the water-parting lies within 300 miles of the Atlantic, and the Zambesi flows almost entirely across the African continent towards the east. The highland to the south of the Zambesi fingers out towards the sea over Marico and Sofala, giving rise to a series of secondary coast rivers; but in the other direction it extends on either hand to the precincts of the Kalahari Desert and the sources of the Congo. The Gold Region explored by Mr. Baines's Expedition lies in the heart of this highland.

Having crossed the Marico River, Mr. Baines paid a passing visit to Matjen, the Chief of the Bamangwato, and describes his chief place, Shoshong, as a large cluster of shabby huts, reached through a luxuriant valley laden with waving corn. The chief Matjen was the son of Ingwato, from whom the tribe of Mangwato—or, with the plural prefix, Aba-Mangwato (Bamangwato)—takes its name. When a lad, he was in thrall to Mosilikatze, and had been placed in his present position through the friendly offices of the elder Moffat, with the River Macloutzie appointed for the boundary of his territory.

The River Macloutzie was crossed on the 7th of June, and a short visit paid immediately afterwards to the Miners' Camp at the Tati River. There were at that time several parties working there in shafts 50 feet deep, which had been made by jumping and blasting. The miners were, however, chiefly endeavouring to make their way to a richer lode. The River Tati is a feeder of the Shashi, which joins the Limpopo at its north-eastern head, near to Zoutpansberg.

Nine days after leaving the Tati, Mr. Baines reached the Mungwe River, where he found an Englishman, Mr. Lee, acting as the accredited agent of the Matabele tribe, the first outposts of that tribe being at Manyama's place, one day's journey farther on.

Between the Macloutzie and Manyama's outpost, the country belongs chiefly to the Makalaka Kaffirs, who are, however, held in subjection by the Matabele.

At Manyama's it was determined that messengers must be sent on into Matabele land, to announce the visit of the Expedition bearing letters from the Governor of Natal to the Matabele chief. The messengers returned in fifteen days, with instructions to take Mr. Baines on to Um-Numbata, who was at that time acting as a kind of temporary regent to the tribe, in consequence of the recent death of the old chief Mosilikatze—more properly known as Umseligase—and some uncertainty as to who was to succeed to the chieftainship.

The Matabele tribe is, in reality, one of the great offsets of the warlike and aggressive Zulu tribe of the south-eastern coast, and is marked by the same leading policy and characteristics. One of the wives of Umseligase was a daughter of the Amaswase chief Umsitu; and Zulu, who gave the name to the great Coast tribe, was a brother of this Umsitu. This wife of Umseligase had two children; of whom one was named Kurumane, most probably from the station of the friendly missionary Moffat. This lad had come up with the Matabele tribe from the south-east, when about seven years old, driving oxen before him. The oxen went to the north-west as they multiplied; but, upon a certain occasion, when Umseligase was on the Zambesi River, the party with whom Kurumane was became compromised in a suspected conspiracy, and their kraal was ordered to be destroyed. Kurumane disappeared from this time; but it was now said that his life had been intentionally spared under Umseligase's orders, and that he was living in seclusion in the colony of Natal. One section of the Matabele people, under the leadership of an old chief called Umbigo, who was not properly a true Matabele, were looking to the succession of Kurumane. But a much larger section of the people, under the regent Um-Numbata, were looking to the son of a younger wife of Umseligase, known as No-Bengule.

In passing the Un-Kwesi River, illustrations were encountered of the aggressive spirit of the Matabele. There were blackened ruins of the kraals of a chief called Makhobo all over this district, who was said to have been destroyed, with all his people, as lately as the year 1864. As Mr. Baines was travelling to the Inyati mission station, at a later period, a party of armed Matabele passed him, who had been avowedly sent to intercept messengers despatched by Umbigo to communicate with Kurumane, but who were driving a herd of Mashuna cattle before them, which they had taken, as they explained, to pay the cost of the expedition.

Mr. Baines started with his own party, the two messengers, and Mr. Lee, on the 6th of July. About 12 miles from Manyama's, and 23 from Mungwe, the crest of the great watershed was reached. It was in Lat. 19° 42 49″ s., about 80 geographical miles N.N.E. of the Tati River Camp, and was crossed at an elevation of about 5052 feet, the aneroid barometer standing at 24·64 inches, and water boiling at 204·1 degrees of Fahrenheit. The nights at this time were generally below freezing temperature of the thermometer, and on one occasion descended to 24·5°.

The Kumalo River, the first affluent of the Zambesi system, was reached on the 8th of July, and one of the two wagons was left behind, while the second went on with Mr. Baines, Mr. Nelson, and Mr. Lee. The head-water of the Gwaii, or Tobacco River, at the junction of which with the Zambesi Mr. Baines had been in 1862, was passed, on July 12th, at a spot which was estimated to be about 130 miles from the Zambesi. Umbigo's Kraal, on the Im-Pembis River, was reached on the 14th of July, and from this a direct route was made to Um-Numbata's Kraal, known as Manpanjeni, to the east. The Natal Governor's letter was read and explained to the old chief by Mr. Lee, and the object of the exploration gone into. Um-Numbata at once said that he could give the free permission for the exploration, but that Mr. Baines must come back to him, and give an acount of all his proceedings before he left the country. Um-Numbata said he knew what it was to have to travel so far, for he had himself been twice sent to the Great Sea by Umseligase. It appeared that he was one of the two messengers whom the elder Moffat had accompanied back from Kurumane, to protect them from surrounding hostile tribes; which circumstance was the commencement of the friendly relations with Umseligase which led to the establishment of the Inyati mission station, upon the occasion of Dr. Livingstone's return to England, from his journey to Loando, in 1856.

On the 7th of August the northward journey was resumed with one wagon. The route now lay along the northern slope of the watershed and over the head-waters of the various affluents of the Zambesi. Beautiful mountain-streams, fringed with overhanging trees and edged with water-lilies, stretches of bare rocky granite-encumbered ground, and sloping valleys green with Mimosas and Bauhinias, and variegated by large aloes and the Candelabra Spurge, were passed in succession. At the River Imbeela, a little beyond the Serua, the elephant-hunter, Mr. Hartley, was found. On the 1st of September, a Mashuna chief, named Amakonda, took Mr. Baines over the Chingasora River to a high quartzose region,

where there were a series of old Mashuna workings for gold; and, on the following day, to another group of workings on the Kanyamatimba River. From this until the 17th of September the country was explored in all directions. On the 9th, a very successful hippopotamus hunt was enjoyed, in a pool 9 miles down the Ganyami River. The extreme point reached was in Lat. 17° 35′, probably within 50 miles of the Luenja branch of the Zambesi, well known to the Portuguese as yielding gold. Some days were now spent in careful examination of some very interesting Mashuna workings that had been pointed out by Mr. Hartley between the Simbo and Serua rivers. This spot was in 18° 10′ s. lat., and 30° 50′ E. long., and at an elevation of 3525 feet above the sea. High ground in the immediate neighbourhood was designated "Hartley Hill," in compliment to the veteran hunter.

The workings were on elevated ground on two distinct ledges of quartz, about 500 yards asunder. The reefs had been broken up into shallow pits from 6 to 8 feet deep, which are now filled up with the refuse fragments of broken rock. In some of the pits trees, 4 and 5 inches in diameter, had grown. The workings seemed to be at most from 150 to 200 years old. They are certainly the handiwork of a people who are known as Mashuna Kaffirs, who occupied the district before Umseligase and the Matabele attacked them and drove them back towards the Zambesi. These Mashunas are a friendly, industrious, peaceable, and very ingenious tribe. They make fine iron from magnetic iron-ore, grow cotton, and weave textile fabrics, and are in these particulars far in advance of other tribes occupying the neighbourhood. How, in the absence of suitable tools, these ingenious people managed to break up the hard quartz-reefs remains still a mystery. But it is quite clear that the choicest fragments of quartz taken from the reef were pounded in holes in the hard rock by round stones, and that the crushings were then washed in bowls of wood and clay.

Recognisable beacons were placed round these workings, and a formal application for a cession of this particular piece of ground to the Company for mining purposes was agreed upon.

The quartz-veins contained in this ground were enclosed in gneiss and a mixture of talcose and chloritic slates. The stratified rocks throughout the district were, however, so hardened and metamorphosed, that it was not easy to refer them to their proper geological age. The breadth of the veins below could not be satisfactorily determined, on account of the way in which they were buried in the débris of fragments. Specimens taken from te débris somewhat promiscuously have been submitted to careful assay

in England. These specimens yielded gold at the rate of 0·85, 0·97, 1·95, 3·12, 3·50, and 8·15 ounces per ton. From one choice piece of quartz there was a return of gold at the rate of 60·75 ounces, and of silver at the rate of 17·1 ounces per ton. There can be no doubt that the specimens selected by the Mashunas from this refuse had been of a still richer character. Granite forms the foundation ridge of the watershed, and is in many places intersected by felspathic greenstone, and associated with different forms of gneiss and hornblende schist, and with a hard rock containing talc and quartz. A dark-coloured slate-formation, about a mile across in places, forms high perpendicular bluffs on both sides of the river-channels. This slate-band also forms regular mountain-ridges that can be seen for a long distance. The quartz-veins are mainly contained in this slate. The gold occurs where the stratified rocks come into relation with the central granitic axis, and not in the granite itself. Hence gold is found among the affluents of the Limpopo on one side, and among the affluents of the Zambesi on the other side of the crest of the watershed. Small quantities of alluvial gold are found in some of the rivers, especially in the river Ganyami.

On the 1st of October Mr. Baines received a message from the Inyati mission station, intimating that all white travellers were required to withdraw from the Matabele territory until the question of the succession, now coming to a crisis, had been determined. He accordingly forthwith began to retrace his steps, availing himself of every opportunity to extend the exploration of the country by the way. The station of Inyati was reached the 21st of October. Shortly afterwards a visit was made to Um-Numbata to report progress, and to No-Bengule to solicit his friendly regard. The month of November was spent at the Mungwe River, and Christmas at the Tati settlement. On the 4th of January, 1870, Mr. Nelson started from the Mungwe River to convey the general report of proceedings to England. On the 10th of January Mr. Baines and Mr. Lee went off from the Mungwe to pay a second visit to No-Bengule, who was then at a place called Um-Ihlatlangalor, 60 miles from the Mungwe, and 7 miles from the Kumalo River, on the east slope of the watershed. They found several distinguished Indunas, Fortress-Mouth, Umtigaan, and the fighting general of the tribe, Umkaitcho, among them. Bands of warriors wearing the black ostrich war-plumes and cloaks were arriving daily; and they were told that they had better say nothing more regarding Kurumane, as there was now no belief in his being alive. It appeared, from conversation with the chiefs, that the Ramakhoban River district was con-

sidered Mr. Lee's hunting-ground, and that it was desired he should hold himself responsible for white men visiting that region. He, however, considered it quite impracticable to assert exclusive rights there. The Transvaal States had claimed the territory up to the Ganyami and Gwaloo rivers. They had, indeed, named a parallel of latitude as the northern frontier of the states, but had admitted that they had no means of determining this parallel. Mr. Baines's remark was that they had about as much chance of exerting any real influence over this wide open region as the "watch dog that scares a wolf from the traveller's wagon." No-Bengule was very cordial to Mr. Baines, breakfasting with him in public; and it was arranged that he was to return again to see him after the completion of his installation as chief, for which ceremony it now appeared the Matabele people were gathering. In about six days Mr. Lee was recalled from the Mungwe to be present at the ceremony, which consisted in a dance of 9000 warriors, mainly remarkable for the identity of its character with the ceremonial dances of the warlike Zulus. The champions who advanced themselves from the ranks from time to time, to proclaim their individual prowess, were loud in their denunciations of the "Man in the Sea" (that is, the reputed Kurumane), and included in their denunciations all who wrote letters concerning him, and carried those letters, or, indeed, even read them. On the 23rd of January, the first act of authority was performed by No-Bengule in selecting oxen for sacrifice—the black oxen being offered to the memory of the defunct chief, and the speckled ones to some supreme power who was spoken of as "Molimo." On the 5th of April, Mr. Baines again came up to No-Bengule, taking the opportunity to perfect his examination of the geography of the watershed by the way. He then ascertained that the gold-workings at Hartley's Hill were certainly within 174 miles of a navigable river, by the Sabia route. He found No-Bengule at a spot where a new royal kraal, to be called Gibbe Klaike, was in process of formation. This spot is a short distance from Um-lhlatlangalor, on a slope on the southern side of the watershed overlooking a broad expanse of ridges and valleys which run down either to the Limpopo or the Sabia river. Mr. Baines now proposed to No-Bengule to cede to him the land lying between the Gwaloo, or U'gwelo, and the Ganyami River, for mining purposes. After two or three interviews, No-Bengule told him he could not alienate the land, but that he was prepared to give him permission to explore for gold in that region, and to introduce tools, implements, and necessary material, and to erect storehouses and dwellings, and that Mr. Lee was to be accredited as the agent for mutual communication

between the chief and Mr. Baines; while, with No-Bengule, Mr. Baines prepared a general statement of Matabele affairs for the use of the Colonial Secretary in Natal; and this letter was read over to No-Bengule, and, with some trifling corrections, approved by him. No-Bengule kept Mr. Baines with him at and in the vicinity of Gibbe Klaike, in constant friendly intercourse, during seventeen days, and then parted with him with apparent unwillingness. The latitude of the New Kraal was determined to be 20° 18′ 11″ s. The parting present to the chief consisted of Mr. Baines's own riding horse, two bags of gunpowder, two bars of lead, a box of percussion-caps, a pair of white blankets, and a white grass-cloth coat. No-Bengule walked half-a-mile with the departing wagons, and told Mr. Baines that his heart was sore at losing the companionship of his white friends.

At Gibbe Klaike Mr. Baines met Captain Elton, who communicated to him his purpose to descend the Tati and Shashi rivers, to the Limpopo, in a boat—a feat which he has since happily accomplished—losing his boat somewhere on the Limpopo, and making his way across the Wild Veldt to the Portuguese station of Lorenzo Marquez, at Delagoa Bay. Captain Elton was at Lorenzo Marquez on the 8th of September, and was then going on with the British ship *Wainwright* to Quillimaine.*

Mr. Baines left Gibbe Klaike for the Inyati mission station on the 24th of April. The last section of his Journal which has been received was dated from Inyati on the 2nd of May, 1870. Letters have, however, been more recently received, which show that he was again at Gibbe Klaike, and holding personal intercourse with No-Bengule, on the 19th of November, 1870. The chief had then confirmed him in all his privileges. He had asked him how much gold he was going to take away, and what he proposed to give him "as big as the gold;" but was most careful to have it understood that this did not mean selling the land. It was finally arranged that the difficulty was to be met by an annual present for the right to explore and mine between the Gwaloo and Ganyami rivers. Mr Baines had at this time again been up to the district in this locality, and had collected fresh specimens of gold-bearing quartz and commenced the construction of a house near Hartley's Hill. He found that the Mashunas had resumed operations, having placed a quantity of crushed quartz in layers alternated with wood, obviously with the intention of roasting the mineral. He had purchased a

* Captain Elton was wrecked in the ship *Wainwright*, near Inhambane, and after many perils by land and sea, returned to Durban in the *Roe*, in April last.

small quillful of gold, and was told that the rest of the gold-harvest had gone down to the chief Watah (whose town is a short distance to the N.E. of Hartley's Hill) on its way to the Portuguese settlements. On the 8th of December, No-Bengule's wagon had returned from Natal with information that the man there reputed to be Kurumane was certainly not so. On the 7th of January, 1871, Mr. Baines was at Potchefstroom, in the Transvaal State, where he had seen the Portuguese Governor of Quilimane, Signor Carlos C. B. è Costa, who had protested against any gold-mining being carried on in the Matabele land without the permission of the Portuguese Government. Mr. Baines had, however, been able, by reference to the Governor's own maps, to prove that the district in question, between the Gwaloo and Ganyami rivers, and comprised within the 19° 11′ 51″ and 17° 44′ 56″ of latitude and the 29° 50′ 10″ and 30° 41′ 20″ of longitude, could, in no sense, be held to fall within Portuguese territory or Portuguese jurisdiction.

The paper will be published, with a map, in the 'Journal,' vol. xli.

Sir John Swinburne said that he had frequently met Mr. Baines in the country which had been described, during the year 1869. On his arrival with a small party at the Umfule River, in the month of July, he explored a great number of old gold workings. It was an unusually dry season, and the natives had set fire to the grass, reducing the rank herbage to a mass of black ashes, in which one walked ankle-deep. Consequently, the bullocks drawing the wagon were nearly starving; and his party were but little better for some days, as the game with which this part of the country abounds was so lean as to be almost uneatable, and the sheep they had taken with them were reduced to a weight of 25 lbs., being little better than living skeletons. Leaving his party (with the few remaining ounces of tea, sugar, and flour) to prove the value of the gold-reefs at the Umfule, he started, with his faithful servant Murphy (in quest of food), for the Mashuna tribes, who live on the eastern slopes of the watershed which divides the rivers running direct into the Indian Ocean from those running to the west and falling into the Zambesi. They travelled about 90 or 100 miles to the south-east, until they arrived at the watershed, whence they descended a short distance down the eastern slope, where they came across the first Mashuna village, named See-sow. The first intimation he had of the presence of natives in that neighbourhood was hearing, one frosty morning, most harmonious singing in the distance. He at once started off in the direction in which he heard it; and found the village some 3 miles off, situated in the cliffs and fissures of enormous granite boulders. The voices which had been heard such a distance were those of the bellows-blowers of a small blast-furnace, which was kept in blast night and day, just outside the stockade of the village. This furnace was a perfect miniature of a blast-furnace in England, height about 4 feet—the whole being made of fine clay; orifice at top, about 8 inches in diameter. The ore was a red oxide of iron, in a laminated form, not very rich. About three handfuls of charcoal were put in to one of ore, the latter being previously broken into the size of hazel nuts. The blast was formed by four goat-skin bellows, worked by two persons holding a skin in each hand, a wooden nozzle leading from the leg of the goat-skin to a clay tuyere, the open mouth of the skin being closed by the

hand when pressed down. By this means a most perfect and continuous blast was kept up. The ore was not reduced to quite a fluid state, but when drawn out—which took place about every six hours—it was in a coagulated condition. A half-broken stick drew it out from within the screen which surrounded the furnace, and the bloom was then beaten with a club to rid it of slag. Each bloom weighed about 12 lbs. The charcoal and ore were obtained in the immediate neighbourhood, while the tuyeres, bellows, and baskets for carrying ore and charcoal were made on the spot. In fact, nothing could be more simple and effective than these miniature iron-works. The whole of the villagers appeared to take their turn in keeping up the blast. Very good iron hoes, weighing about five pounds, were bought for a quarter of a pound of beads, worth about a shilling. The Mashunas are very expert in the making of iron hoes, spear-heads, iron beads, anklets, and keys for musical instruments. But they did not manufacture tools at this village, but handed the iron over to their friends a few miles off, who made it into various implements and ornaments. The women at this village especially delight in loading their legs with iron rings as thick as one's middle finger. On some he counted no less than seven of these manacles on each leg, which greatly incommoded their walking; but to be dressed in the height of fashion, here as all over the world, they cheerfully submitted to hardships which any European convict would have rebelled against. As far as he could learn, these rings were put on when the metal was red hot; but to accomplish this they must have covered the leg with raw hide, or some such protection, as they fitted almost tight. At this village of See-sow they were exceedingly hospitable, supplied him with everything as far as their means would allow, and gave him every information, and stated that at the next village we could procure some sheep. Three or four miles from this village they met a trading party with neatly-made spear-heads, hoes, and axes. They were on their way to tribes further to the south-east, who were in direct communication with Portuguese traders, and expected to get glass beads and cotton cloth in exchange for their ironwork. A large trade appears to be done by these Mashunas in iron implements. These travelling parties of traders generally have three or four musical instruments, with which they divert themselves when resting between their toilsome marches. It is a point of etiquette to receive strangers with music; and on this occasion they entertained us with strains from Pandean pipes, a tambourine, and the *sansa*,—an instrument formed by a number of iron-keys, fixed on a frame inside a large gourd, which latter acts as a sounding-board. Five miles from See-sow they arrived at Inyorka's (the Serpent) Town. Inyorka had in his youth been addicted to appropriating his neighbours' property, and, consequently, when on one occasion he was captured by his enemies they cut off both his hands. His people were greedy traders, and were so overreaching and exorbitant in their demands that little could be obtained from them. The women, who always conduct the sale of corn and all products of the land, were exasperated at the grasping spirit shown by their lords, and, setting them at defiance, told them in very strong native language to keep the sheep and cattle, but they were not to be deprived of the opportunity of obtaining beads and cloth; consequently, we obtained as much maize flour, millet, ground nuts, fowls, eggs, rice, &c., as our wagon could carry. All over South Africa it appears to be the custom to consider the garden produce as the women's especial property; and naturally so, as they do the greater portion of the agricultural labour. While trading at Inyorka's, a noted chief of the name of (in English) Stay-at-home, arrived. He had been given this name from having remained to defend his town, situated on a high pinnacle of rocks, from the Matabele when all his subjects had deserted him. Of course, his town was taken; but the Matabele, respecting his gallant conduct, gave him his liberty. On Stay-at-home's arrival at the wagon, with a whole company of followers, he was received

with great honour by the women, who raised a peculiar cry, or rather howl, by rapidly clapping the hand over the mouth.

Having obtained as much corn, rice, &c., as the wagon could carry, and a few sheep, they returned to the Umfule with the welcome supplies. A fortnight later, letters came up, requesting that all the white men should immediately return to Inyati, and remain there until the new king, No-Bengule, was crowned, and formally installed as supreme chief of the Matabele. This was much to be regretted, as so short a time did not suffice for a thorough testing of the numerous gold-bearing reefs in the neighbourhood of the Umfule.

With regard to the southern gold-fields, which are known to extend over the whole of the district lying between the rivers Shashi and Ramakoban —which country has been conceded to the London and Limpopo Company— there are numerous reefs of auriferous quartz, nine of which have been more or less explored.

In most of the mines two shafts have been sunk to an average depth of 50 feet: one shaft in the Blue Jacket Mine is 65 feet deep. The reefs consist of quartz, between walls of chloritic schist. The strike is from north-west to south-east, and the dip about 50° to the south-west; they vary from a few inches to 6 feet in width. There are two descriptions of quartz. One red and honeycombed, and containing much oxide and white iron pyrites; traces of sulphurets and carbonates of copper are also met with; the gold is fine, and mostly found in the oxide of iron, only now and then it is seen in the white quartz without iron. The other kind of quartz is of a bluish-grey appearance, without any iron, and of a finer texture; this quartz is found in the Blue Jacket Mine, 3 miles to the eastward of the main Tati settlement, in a vein 6 feet thick; the gold in this quartz is coarser, and more evenly disseminated than in the red ore. Three shafts have been sunk at the Blue Jacket Mine to the depths of 20, 52, and 65 feet respectively, and the vein worked to the depth of 68 feet; the dip is about 45°. Between the front wall of this vein and the country there is a layer of slate casing which contains gold; this slate is sometimes exchanged for a thin, hard layer of cement, when the ore is usually richer. A seam of calcareous rock is always found where the reef is jointy; some of the whitest quartz contains good samples of gold, and the ore grows richer as the depth increases.

The Flyblow Mine is 10 miles north-west from the settlement. Two shafts have been sunk to the depth of about 50 feet. The reef is 13 inches thick, but very rich, as it is calculated to return four ounces to the ton; but the containing rock is very hard, which makes the working expensive.

The New Zealand Reef is within 500 yards of the settlement and Tati River. No. 1 shaft has been sunk to the depth of 70 feet, and a level driven along the reef about 7 feet in height and 20 feet in length. The reef is 18 inches thick, and will pay from one to two ounces per ton of ore. No. 2 shaft is sunk to the depth of 60 feet. The walls are of chloritic slate.

The Ramakoban, or Halfway Reef, is situated 13 miles north-east of the Tati settlement, and 7 from the Ramakoban River. The reef varies from 5 to 7 feet in thickness. The reef containing gold can be traced along the surface for over 500 yards; and only two shafts, 20 and 25 feet respectively, have been sunk on this mine, for want of means.

The New Mine is within 3 miles of the Halfway Reef, and is very similar. The reef can be traced for 200 yards on the surface.

From the Blue Jacket, which has been opened out to a greater extent than the other mines, 38½ tons of ore produced no less than 71 oz. 13 dwts. of gold, worth 3*l.* 15*s.* per ounce, being at the rate of nearly two ounces to the ton; while two other small parcels, of 2½ tons each, produced no less than 16 oz. 10 dwts. and 26 oz. of gold respectively. These parcels of ore were

from another mine higher up the River Tati. These results were obtained by means of a small Natal-made stamp-mill, which was sent up by the London and Limpopo Company, more with a view of practically testing the value of the reefs than as a permanent piece of machinery. Steps are now being taken to send up heavy machinery, when a large and steady supply of gold may be expected to be yielded. The healthiness of the climate, the abundance of provisions, timber, and water, should make these mines capable of being very cheaply worked; especially as, by accounts lately received, the Makalakas—a tribe of hard-working natives, subject to the Matabele—are willing to work underground, and soon become as efficient miners as the white men, only requiring to be directed by a white overseer. He had much pleasure in now showing them an ingot of gold, weighing no less than 28 ounces; and he had just received another parcel, weighing 40¼ ounces, both the produce of the Blue Jacket Mine. When it is considered that in the great auriferous quartz-mines of Brazil and Australia 4 dwts., or one-fifth of an ounce, is sufficient to cover all expenses, it will be seen that these returns promise very large profits. When, in 1868, through Mr. Mauch's explorations, these gold-fields came into notice, numbers went up from the colonies, hoping to find alluvial deposits of gold, and returned much disappointed; for, although the river-sands produce traces of gold, it is almost physically impossible to have rich alluvial deposits, as the country is nearly flat at the sources of the rivers. The only thing required was a settled and strong government, and he wished the British Government would take the Matabele race under their protection. The natives desired it exceedingly, and he hoped he should live to see the day when the whole of the country south of the Zambesi would be under British rule; for at present slavery, in some of its worst forms, and kidnapping, is carried on by the Dutch boers on the frontiers of the Transvaal Republic, which leads to reprisals being made by the Kaffirs. He concluded by expressing his thanks for the valuable assistance and information given him by Mr. Baines in that remote country.

Mr. GALTON said Mr. Baines's contributions to geography from this last journey were very considerable, the map which he had made being in reality an itinerary through a district extending over more than 750 miles. Probably no living man, not even excepting Dr. Livingstone, has been so pertinaciously engaged in travelling as Mr. Baines. Twenty years ago he made his first expedition northwards in Africa, but was driven back; afterwards he went to Australia, and was connected with Mr. Gregory's exploration; then he joined Livingstone in exploring the Zambesi; next he travelled on the west side of Africa; and now he was engaged in examining the gold-fields near the Limpopo. His pictorial contributions to geographical and ethnological knowledge were exceedingly numerous and valuable.

The CHAIRMAN said that General Rigby, who was for a long time Consul General on the Coast of Zanzibar, had told him that for many years past a very extensive trade in gold had been carried on upon the African coast, but he thought the gold did not come from a district as low down as the Limpopo, but rather from the country between the Limpopo and the Tanganyika Lake. No traces of gold had been found by Burton, Speke, or Grant, or any other travellers, north of that lake. A line of gold deposits probably connected that district with the quartz formations which had been described. One of the great objects of the Royal Geographical Society always had been and always would be to combine, as far as possible, geographical science with practical economical results, and he therefore trusted that the Society would approve of the Council's having brought before them this subject of the South African gold-fields.

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CHART OF THE
WORLD
illustrating Gall's Projection.
Published for the Journal of the Royal Geographical Society by J. Murray, Albemarle Street, London, 1870.

ADDITIONAL NOTICE.

(Printed by order of Council.)

On a New Projection for a Map of the World. By JAMES GALL.

HAVING occasion to publish an 'Atlas of the Stars,' I was anxious to produce a panoramic view of the equatorial heavens, extending as far northward as possible; and my object was, of course, to conserve the appearance of the constellations both in regard to form and comparative area. I first attempted Mercator's projection, but the result was not satisfactory: the orientation, indeed, was perfect, but everything else was sacrificed. It then occurred to me that if, instead of rectifying the latitude to the longitude throughout, we rectified it only at the 45th degree, we might adopt the stereographic latitudes up to the 60th degree without any distortion.

It then occurred to me that the same projection would be applicable to a cylindrical map of the world, and would be a great improvement on Mercator, by extending the stereographic latitudes to the pole. I drew a map on the new projection, and being satisfied with the result, I read a paper before the British Association in Glasgow, in 1855.

Since that time I have greatly improved it by adding Polar supplements of the same projection for the Arctic and Antarctic regions; and on showing it to some of my publishing friends in Edinburgh, am pleased to find that it has received their approval, and been adopted, instead of Mercator, for their publications.

I venture now to submit it to the judgment of the Royal Geographical Society.

FORMULA OF THE MAP.

The lines of latitude are projected stereographically to the Poles, and the lines of longitude are rectified to the 45th degree of latitude. The Arctic regions are supplemented above by semicircles from the pole along the top of the map, and the Antarctic regions by semicircles, or by one circle below, according to convenience.

ADVANTAGES OF THE MAP.

1. The geographical features are not distorted.
2. The comparative area is much conserved.
3. The whole world is for the first time represented; and
4. There is a great saving of space in the map, as compared with Mercator.

JAMES GALL.

Moray Manse, Edinburgh.

PROCEEDINGS

OF

THE ROYAL GEOGRAPHICAL SOCIETY.

[ISSUED AUGUST 14TH, 1871.]

SESSION 1870-71.

Ninth Meeting, 27th March, 1871.

MAJOR-GENERAL SIR HENRY C. RAWLINSON, K.C.B., VICE-PRESIDENT, in the Chair.

ELECTIONS.—*Commander John Charles Best; Joseph Cubitt, Esq.*, C.E.; *Francis Horne, Esq.; Murdock G. Maclaine, Esq.; Hugh M. Macpherson, Esq.*, Inspector-General of Hospitals; *Lieut. W. W. Vine*, R.N.

ACCESSIONS TO THE LIBRARY FROM MARCH 13TH TO MARCH 27TH.—'Journal of a Voyage up the Irawaddy to Mandalay and Bhamo.' By J. Talboys Wheeler, Sec. to Chief Commissioner British Burmah. Purchased. 'Untersuchungen ueber die Lehre von den Meeresströmungen.' Von Dr. A. Mühry. Donor the author. 'Comptes Rendus de l'Académie des Sciences,' to date; and other periodicals to date.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING OF MARCH 13TH.—Photographs of Georgian Churches, &c., in Tortoum, a district of the old Armenian Province of Taik. 47 in number. Presented by M. Ermadoff. A specimen of an impression from a cuneiform inscription connected with the above photographs. Presented by Mr. Taylor, Consul at Erzerum. Rough Plan of the South Gate of the town of Tank, the scene of Sir H. Durand's accident, Dec. 31, 1870. Karten und Mittheilungen des Mittelrheinischen Geologischen Vereins. Section Glandenbach. Von R. Ludwig. Presented by the author. Ordnance Survey on 1743 sheets, on various scales. Presented by the Chief Commissioner of Works, through Sir H. James, R.E.

The following letter, from Sir Samuel Baker to Sir Roderick Murchison, was read :—

"Tewfikeeya, White Nile, N. Lat. 9° 26',
"6th December, 1870.

"MY DEAR SIR RODERICK,

"I write you a few lines to explain my movements.

"In October, I returned to Khartoum (680 miles by river) to assure myself that the requisite preparations were made, according to my previous instructions to the Governor. I then came on here by steamer, and, upon the commencement of the north wind, my vessels from Khartoum arrived with supplies and fresh troops, according to the plans I had laid down.

"Having sent back all my sick, I started off, on the 1st inst. the first division in eight vessels—followed daily by sections of the flotilla, which numbers in all fifty-nine, including one steamer.

"During my stay at this station, I have entirely suppressed the slave-trade of the White Nile—not one slave having passed down the river to Khartoum. The steps that I took upon my immediate arrival completely intimidated the traders, and the traffic no longer exists.

"I trust that England will appreciate the sincerity of purpose displayed by His Highness the Khedive in thus purifying the river from the abominable trade. My acts naturally raised much indignation in the Soudan; but His Highness has supported me unflinchingly, and has dismissed the Governor whom I had reported, as a kidnapper of women and children under the plea of collecting taxes. His Highness also forwarded me the Firman of Pacha from His Majesty the Sultan, together with a very complimentary autograph letter.

"I have now two of Samuda's steamers with me, in sections, together with all stores, merchandise, ammunition, &c., in excellent order, thanks to my galvanized-iron magazine. The station appears quite deserted, as only four companies of troops remain, with which I shall bring up the rear on 9th inst.

"During my stay here, I have made every preparation for cutting through the dams of vegetation in the Bahr Giraffe. Three hundred bill-hooks, &c., are beautifully sharpened; and several new rowing-boats have been built by our English workmen, the want of which caused great inconvenience last season.

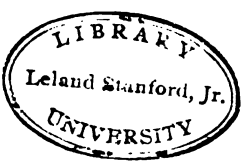
"The White Nile is exceedingly high this year, which is all in our favour. It rose from the lowest level of the dry season to a maximum 14 feet 3 inches, and has only fallen 2 inches. Thus, as we start with a powerful force and a strong and steady north wind, I do not fear the impediments of the river. I have also armed the men with some hundreds of hoes, fitted with long handles, so as to cut a channel through shallow places, should they obstruct the passage.

"I shall write to you upon my arrival at Gondokoro, whence I shall push on with the 80-foot steamer, in sections, and the two steel lifeboats (sailing). Fortunately, I have all I require, including fifty wagons, in which all cumbrous sections will be conveyed.

"I shall leave everything that is not absolutely necessary at the main depôt at Gondokoro, to be brought up by degrees in carts, when the permanent road shall have been completed.

"When at Ibrahiméya, the 2nd depôt (3° 22' N. lat.), with the steamer and boats, I shall be all right. I shall then put together the two lifeboats, and examine the river to the Albert N'yanza. If all is clear, I shall hurry back, and set all hands to work in constructing the 80-foot steamer.

"Monsieur de Bigemont, who was to represent the French Geographical Society, arrived at Khartoum, but immediately returned to France upon the news of the war and the fall of the Empire. Thus I lose a very intelligent and charming companion. Lieut. J. A. Baker, R.N., is a most able representative of the British Navy in activity and energy. He is unremitting at his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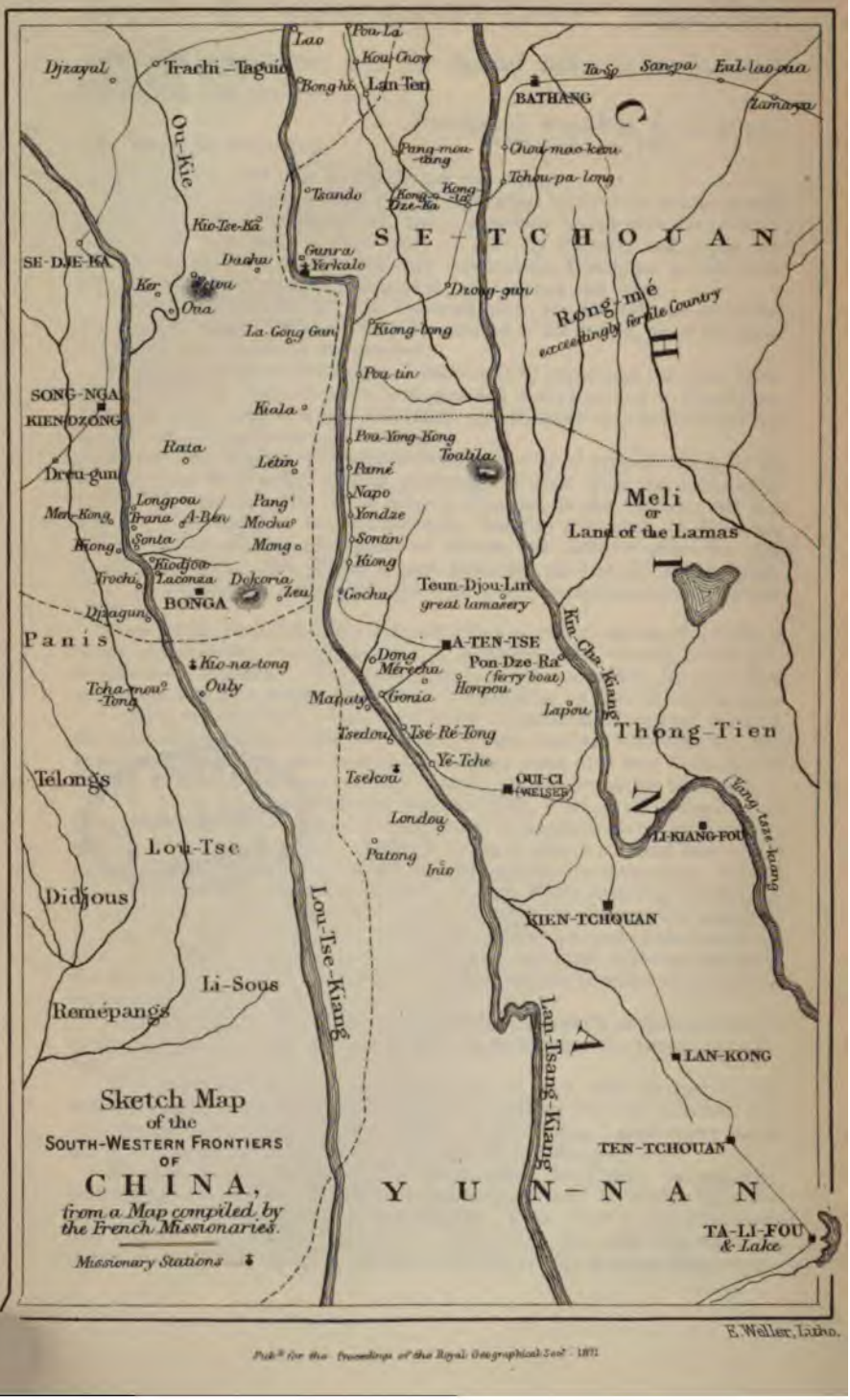

E. Weller, Lithog.

Pub.d for the Proceedings of the Royal Geographical Soc.y 1871

work, and will bring home for the Society most valuable results of careful observations.

"The chronometers went very wild after the land journey from the Red Sea, therefore they were allowed to run down, and remained dormant for some months. They have been wound up and rated, carefully corrected by numerous observations within the last two months, and one is now going remarkably well.

"We have had much sickness in camp during the rainy season. Poor Dr. Gedge *lost* his reason entirely, and became very violent. There was no hope, and *I* had him conveyed to Khartoum. After some weeks, during which he frequently refused nourishment, his unhappy malady ended in death. Thank God, we have been free from all ailments, and my wife and I are as well as when in Europe. With love from us both,

"Ever affectionately yours,

"Samuel W. Baker."

The following paper was then read by the author :—

On the Chinese Province of Yunnan and its Borders.—By T. T. Cooper.

At the present time the Chinese province of Yunnan is attracting attention in its geographical, commercial, and political relations with the adjacent countries. It has been, so to speak, attacked from three sides, and that almost at the same time, by explorers acting independently of each other; viz. :—the French expedition from Saigon, on the south; Major Sladen's party, on the Burmese or western side; and, last and least, an attempt was made by myself to reach Talifoo from Atenze, on the northern frontier.

Its capital, the city of Yunnan-foo was formerly the residence of a viceroy who directed the Chinese political relations with Thibet and Burmah; and out of the early intercourse between Yunnan and these two countries, arose the events which led to the partial subjugation and consequent political relations which have heretofore existed between the Chinese Government and the numerous tribes inhabiting the western and northern borders of Yunnan.

As if to compensate for the wildness of her borders, the interior of the province may be said to form a beautiful picture, having for its centrepiece the great Lake of Tali-foo, 45 miles long and 15 wide, navigable for vessels drawing 6 feet, and abounding in fish; while nine so-called plains are famous for their various agricultural and mineral productions. The Plain of Tali-foo, surrounding the lake, on the banks of which lies the city of that name, ranks first in area and population, which latter numbered, some thirty years ago, no less than 430,000 souls, distributed in more than 150 towns and villages. The next in importance is the Plain of Yuin-chang, lying to the west of Tali and extending nearly to Ten-yua-chew. This plain is called the rice-field of Yunnan, producing an exceedingly fine quality of grain. It is, however, cursed with malaria,

which is a fruitful source of fevers and epidemic diseases. This, however, is an exception to the general climate, which is considered good, and, as far as I am acquainted with it, it is so. From the month of June to the beginning of August, there is a heavy rainfall throughout the province; the sun, however, occasionally shines with great heat during the day, but, in Weisee, I invariably found the nights cool and pleasant, which I was told is the case farther south. After the rains subsided in August, the weather was lovely: bright, sunny days, never too warm to be unpleasant, were succeeded by cold nights, rendering fires in one's room quite a comfort. While in the months November, December, and January, white frost is common everywhere, increasing, of course, in intensity in the northern part of the province, and snow generally falls to some depth on the hills surrounding Weisee every winter.

The Plain of Yunnan-chien, surrounding the capital, is famous for its gold and silver mines; while that of Likiang-foo, lying at a considerable height above the others at the foot of the Sui-shan, or snowy mountains, contains valuable quarries of marble, and the plain of Lankong, further east again, abounds in sulphur mines, and has a high reputation for its sulphuric hot springs; while of the other five, lying in different parts of the province, Kien-chuen and Ho-chin, in the north, possess valuable mines of iron. The other plains, Teng-chuen, Kian-oui, and Ngieon-tsin, I have not been able to identify; but in them, as in other parts of the province, there are rich mines of red, yellow, and white copper—as many as 132 mines having been in work by the Chinese.

Thin-leaved tobacco grows everywhere throughout Yunnan, which for fineness of stalk, delicacy of flavour, and aroma, is superior to the tobacco of any other province in China. The leaf is peculiar in shape, being nearly as broad as it is long, and rarely more than 6 inches from the butt of the stalk to the point; when dried, it is of a pale yellow colour. This tobacco is rarely exported, being consumed by the Yunnanese and border tribes.

The cultivation of the poppy has been such as to gain for Yunnan opium a preference over that grown in the neighbouring provinces of Sz-chuen and Kwei-chow. Black tea, in the south and west of the province was cultivated extensively and is highly esteemed as a luxury by the Western Chinese.

The former fame of the Yunnan artists in jadestone carvings is perpetuated by the passion of the Chinese for jadestone rings and other ornaments carved from the stone which Chinese jade merchants procured from the tribes in the neighbourhood of Mogoung, in Northern Burmah, to the west of the Irawaddy River, where a

small colony of Chinese sprang up. Amber merchants from Yunnan also established trading posts to the north of Mogoung; while cotton merchants purchased from year to year the whole cotton crop of Northern Burmah, the importation of which, by mule carriage, generally commenced about the end of October and ended in April, after which, until the following October, little or no communication took place between Yunnan and Burmah, owing to the prevalence of fever in the Plain of Yuin-chang and the country westwards.

The city of Tali-foo was a favourite resort of the chiefs of all the surrounding tribes. Even Thibetans found their way to its annual fair, held in the third month of the year. Round the suburbs of the city may be seen to this day many marble tombstones hewn from the marble quarries, worked in the peaked mountain rising, out of the plain at the back of the city, like a huge spire. And these tombstones carved with Thibetan inscriptions mark the last resting-place of Thibetans who died on their visit to the famous city. Numbers of Burmese merchants in former days also attended the fair to purchase the superior silk cloths of China.

Tali-foo, as well as Yunnan-foo, were also famous as slave markets to which dealers from Canton, Soo-chow, near Shanghai, and even Pekin itself, resorted for the purchase of female children, numbers of whom were brought for sale by the different tribes visiting the annual fairs, who in their wars look upon women and girls as valuable booty. Caravans, sometimes numbering several hundreds of girls purchased in the neighbourhood of these cities, started regularly every year for the different places I have mentioned, and so great became the traffic in girls, that the authorities in every large town along the routes from Tali-foo to Yunnan-foo appointed officers whose duty it was to inspect the caravans before they were allowed to enter the towns, so as to guard against the introduction of epidemics to which the human merchandize was too often exposed, as they were exposed in the journey to all kinds of privations, fatigue, and cruelty. Although the laws of China do not countenance slave dealing in the true sense of the word, the caravans of girls which left Yunnan were a source of too great wealth to the mandarins for them to enforce the strict letter of the law.

When a caravan was found to be infected with any contagious disease, admission into all towns and villages was forbidden them, and then, dragging along their weary journey by day in all weathers, ill-clad and ill-fed, the older girls might be seen carrying the smaller ones, who were either sick or too young to walk and keep up with the caravan; and at nightfall, when encamped under the

canopy of heaven, the poor creatures, after a scanty meal, would huddle together, the sick with the sound, and thus day by day the caravan would proceed, leaving behind it a long trail of dead and dying, who, by way of burial, became a prey to the packs of hungry wolves which always followed in the rear of the caravans.

In the early part of the last century the fame of the provincial capital was so great that the emperor sent some Jesuit missionaries skilled in engineering to reconstruct the fortifications of the city, and these heralds of Christianity left behind them several monuments of their skill both as architects and workers of metal. A magnificent gateway was erected under their superintendence, and two large brass cannons, over nine feet in length, cast in Pekin by the same fathers, who embellished them with Latin inscriptions, were sent to occupy a conspicuous position near the gateway.

Such was the famous province of Yunnan up to within the last thirty years, as described to me by an old resident, who lived in the province for fifteen years previous to the outbreak of the Mahomedan rebellion, which, though it has left the natural capabilities and resources of Yunnan unimpaired, has destroyed the prosperity arising from them as developed by the industrious population which, before the war, was more than double the number of its present inhabitants.

Although it may seem out of place in a geographical disquisition, a short sketch of the rise and progress of this little known rebellion is absolutely necessary to a proper understanding of the present condition of Yunnan.

It is difficult, from any Chinese source, to gain reliable information on the origin and progress of this Mahomedan rising. The accounts which reach the eastern shores of China through native sources are never to be relied on, and Major Sladen, to whom we are indebted for much valuable information gathered in his late visit to the town of Ten-yua-chew, or Momein, speaks of the want of reliability experienced in the native reports which reached him on the Burmese side.

My information on this subject was gathered from one whose authority, as having resided in the province at the time of the outbreak, is unquestionable.

Some short time previous to the year 1854, the Imperial Viceroy governing at Yunnan-foo became a convert to the new faith, and under his countenance the ranks of the faithful greatly increased, until the Viceroy, probably influenced by ambitious motives, tried to constitute himself a religious authority, and in doing so interfered with the established rites: this interference at once

called forth a remonstrance from one of the twelve elders who had been appointed in twelve different districts to guard the religious welfare of the faithful. This first remonstrance came from the elder in charge of the district of Likiang-foo, and was subsequently joined in by all the other elders. But to no purpose; for, to quote my informant's own words, "the haughty official disdained to listen to the prayer of his co-religionists." Matters soon came to a crisis, and the elder unfurled the white flag of rebellion from the walls of Likiang.

The rising of the faithful at Likiang was approved by the other elders, and the twelve districts almost simultaneously flew to arms, and a religious war, with all its horrors, ensued. "Death or the new religion" was the war-cry. Towns and villages that held out against the swelling wave of Mahomedan victory were overwhelmed and burnt, while the inhabitants were butchered to a man. A panic preceded the Mahomedan march: all who could, retreated before it; and when no longer able to flee, thousands of poor women, in order to escape their inevitable fate, resorted to suicide.

For several years the unchecked tide of Mahomedan conquest swept the western part of the province; its beautiful plains were deserted, and ruins everywhere alone marked the homes of the former population. Yunnan-foo, the provincial capital, was surrounded; and the Viceroy, in order to save himself, signed a treaty with the elder who had been chosen commander-in-chief of the rebel armies.

This treaty gave to the Mahomedans control of the western part of the province, including the city of Tali, while it secured to the Viceroy the city of Yunnan and the country thirty miles to the west of it. On the conclusion of this treaty, the Viceroy sent a despatch to Pekin stating that he had crushed the Mahomedans, and peace was once more restored to the province. But when the real nature of the peace was known at Pekin, an officer was sent to supersede the Viceroy; who, however, declined to obey the emperor's orders. Though he scrupulously maintained his title of "She-tai," Viceroy, he did not openly attack the troops sent from time to time to subdue the rebels; but bribed the leaders to remain personally inactive, and send small detachments, unsupported and betrayed, to meet certain defeat. This desultory warfare, which continued for fourteen years, resulted in the firm establishment of Mahomedan rule over more than two-thirds of the province; and the remnant, remaining under Imperial rule, has at last been transferred to the Viceroyalty of the province of Kwei-chow. As may be supposed, this continued warfare has

caused the total destruction of trade and the loss of more than half the population; in fact, nearly two-thirds of the province has been laid waste, and the ruins of hundreds of villages are buried in a rank growth of vegetation.

The most recent pilgrims from Yunnan to Burmah report that all is tranquil; this, coupled with the accounts of the victorious progress of the Mahomedan usurper in the north-west province of Kan-su, may well make us ask where will the Mahomedan conquest end? Sz-chuen, lying between the two, and containing a numerous Mahomedan population, is only too likely to catch the blaze and suffer from the same conflagration. The result of this Mahomedan outbreak, on the different tribes round the borders, will appear from the following description of the several tribes I have visited.

On leaving Eastern Thibet at the small border town of Atenze, I met at a village, one day's journey to the south, on the banks of the Lantsan, the remnants of a tribe called by the Chinese Goneahs. They, while resembling the Thibetans in their great stature, costume, and manners, were of much fairer complexion, and spoke a language peculiar to themselves, though largely intermixed with Thibetan and Chinese. The women wore the loose-fitting jacket of the Thibetans, with the small plaited petticoat reaching to the knee, and leaving the leg bare below the knee; while the men wore large woollen coats, of the same make as the Thibetan sheepskin coat, and completed their costume by woollen hose reaching to the knee and soled with sheepskin. Their heads were shaven according to Chinese custom, and their long black hair twisted into a tail and coiled round the head. As weapons, they carried the Thibetan knife, about four feet long, and of the same width from hilt to point. The Goneahs are chiefly herdsmen, tending their flocks of goats, which feed on the high and rugged mountains forming the banks of the Lantsan River. They do, however, cultivate a little beard-wheat and peas. This tribe pays the Government an annual tribute, which is collected by Chinese officers, sent from Atenze, in the harvest month of August every year.

Following the Lantsan southwards, the next tribe encountered are the Ludzus, very wild, and inhabiting the mountains which form the watershed between the Lantsan and Nankiang rivers. Emigrants from this tribe have formed a village on the left bank of the Lantsan, one day's march from the Goneah village, and have adopted the pursuits and habits of peaceful cultivators since their conversion by the Catholic missionaries residing at the mission-

station of Tz'coo, a few miles lower down on the right bank. This village, and the portion of the tribe which inhabits the country immediately bordering on the right bank of the Lantsan, are subject to the Yatezu chief, residing at the village of Yatezu, a day's march from Tz'coo; but the main body of the tribe, inhabiting the vicinity of the Nankiang River, are independent savages, living in the caverns of their almost inaccessible mountains, and rarely communicating with the other tribes, and then only to plunder and carry off slaves. They never cultivate, subsisting chiefly on the chase and wild roots growing on the mountains. As hunters, with the poisoned arrow and spear, they are very successful in the capture of mhitton, deer, bears, wild boars, and leopards. They wear but scanty clothing, and allow their hair to grow in long matted locks reaching to the shoulder. The men rarely wear more than a strip of bear or monkey skin round the loins; and occasionally, in the case of chiefs, a leopard, wolf, or bear skin is thrown over the shoulders; while the dress of the women, I am told, is still more limited. The Ludzus can muster at any time over twelve hundred fighting men, and occasionally serve as voluntary allies of the Chinese (for the sake of plunder) in the annual raids made by them into Mahomedan territory. In complexion the Ludzus are naturally as fair as the Chinese, though, being washed and unkempt, they look much darker. Unlike the Thibetan hill tribes, they are short in stature, and have undoubtedly the Mongol type of feature. They have a language peculiar to themselves, but no written characters, and in communicating with the Chinese use certain symbols: as, for instance, a piece of fowl fat, a green chillie, and a piece of chicken liver, packed in red paper, and sent to the chief by the Weisee mandarin, means, "Repair to Weisee with your warriors;" and some equally curious symbol in return signifies the chief's determination to join the Chinese or otherwise.

After passing the Ludzu district the tribes become more civilised and more closely resemble the Chinese. The first are the Mosos, who so closely resemble the more powerful Yatezus, except in language, that a description of the latter tribe will suffice to convey a fair idea of them.

The Yatezus inhabit a strip of country bordering the left bank of the Lantsan, and are governed by an hereditary chief. The tribe is numerous and powerful, holding as tributaries some clans of the Ludzus and the Mosos, as well as a few petty chiefs of the Leisus, who inhabit the valley of Weisee. Previous to the Mahomedan war, the Yatezu chief, as well as his neighbour the Mooquor chief,

paid an annual tribute to the Chinese Government, and acted as an ally in the war which resulted in the supremacy of the Chinese throughout the Leisu country. Now, however, the Yatezus and Mooquors have asserted their independence, and beyond contributing a few men for the fights between the Chinese and Mahomedans pay no other tribute.

In manners and customs the Yatezus are quite Chinese. The men shave the head and wear the tail common in China, and their costume is the loose trowsers and jacket made of blue cotton commonly worn by the lower orders of Chinese. The native costume of the women is very becoming. A short plaited petticoat of cotton reaches from the waist to the knee; while a tight-fitting loose-sleeved jacket, buttoning from the throat, shows their magnificent figures to perfection. By way of stockings, their well-shaped legs are swathed from below the bend of the knee to the ancle in strips of blue or white cotton cloth; and little leather shoes, with pointed turn-up toes, give a pleasingly trim appearance to their feet. As a headdress, they wear neat little caps of scarlet cloth, sometimes varied amongst the women of the Moso and Mooquor tribes by a hoodlike cap of cowrie shells.

The villages of these tribes consist of streets of mud- and wood-built houses, precisely similar in style to those of China, and surrounded by a high mud wall, erected as a protection against sudden surprises. In religion they are Chinese Buddhists, and every village has its joss-house, with a school attached, in which Chinese alone is taught to the Chinese. The cultivation of rice, barley, wheat, tobacco, and opium is their chief employment, though both the Yatezu and Mooquor chiefs possess many gold-mines which are exceedingly rich. They also own numerous herds of very fine black cattle, which they use only in tilling the ground; and pigs and fowls are as common amongst them as with the Chinese.

To the Yatezus succeed the Mooquor tribe, whose manners, customs, appearance, and political relations with China, are identical with those of the Yatezus, a difference of language alone serving to mark the distinction. These several dialects, to my ear, resembled Chinese; but few of the women could understand Chinese when spoken.

Immediately to the south of the Mooquors lies the country of the Leisus. This tribe, according to their own traditions, originally emigrated from the west of Yunnan. There is, however, nothing about them but the difference of language to distinguish them from the Yatezus, Mooquors, and the Tzefans, whose country lies to the south of them. The Leisus are simple cultivators of the soil, and

living in closer communication with the Chinese in Yunnan are, if anything, more Chinese than all the other tribes I have mentioned; the women, for the most part, wearing the Chinese costume. Almost in the centre of the Leisu country stands the imperial Chinese city of Weisee-foo, the residence of the mandarin who manages the political relations existing between China and these tribes. The Leisus, of all the tribes I have mentioned, alone at this moment pay tribute to China. Shortly after the Mahomedan outbreak, the Tzefan district, to the south, and the Leisu country were overrun by the Mahomedans, whose victorious march was only arrested by the united efforts of the Yatezu and Mooquor tribes; and the effects of their visit can even now be traced in the ruins of villages, while they left the town of Weisee half in ruins, and it was not until several years after the Mahomedans had voluntarily left the country that the Chinese regained complete control of the Leisus. Their southern neighbours, the Tzefans, whose territory extends to the district of Talifoo, in outward appearance resemble the Chinese also, but speak a language of their own. These Tzefans espoused the Mahomedan cause, and for long indulged in a predatory warfare against the Chinese and their Leisu subjects; though ready at any time, as I experienced, to side again with the Chinese, if the Imperial cause seemed likely to prove stronger than that of the Mahomedans.

The numerous tribes of Kachyens, on the western frontiers beyond Ten-yua-chew, have been relieved from their partial submission to the Chinese, and seem to exercise their liberty by indulging in petty jealousies and quarrelling amongst themselves, rendering a journey through their country both dangerous and expensive, on account of their rapacity in levying black-mail on travellers. Thus the result of the Mahomedan war, besides destroying half the population and ruining the prosperity of the province, has thrown the frontier tribes into the greatest confusion, and destroyed that order amongst them which (much to the credit of the Chinese) resulted from their political intercourse with them, and converted these tribes, from independent savages, into a most efficient and vigilant guard for her western frontier. This disorder amongst the tribes, coupled with our treaty relations with China (which prohibit all English intercourse, as travellers or traders, with declared rebels), will defer, for some years to come, all profitable and peaceable communication between our Eastern possessions and the Chinese province of Yunnan.

The CHAIRMAN explained to the meeting that Mr. Cooper, the author of the paper they had listened to, proceeded, two years ago, from the seaboard of

China to the western extremity of that country; his intention being to penetrate to India, either by way of Thibet or the country farther south into Assam. He was stopped, however, at the Thibetan frontier, and obliged to return to the sea-coast, after traversing a portion of the wild country along the western border of Yunnan. He afterwards made another attempt from the opposite direction, proceeding by sea to Calcutta, and thence to the north-eastern extremity of Assam. He ascended the Brahmaputra to the Mishmi country; traversed the latter district for 60 or 70 miles, but was at last compelled to turn back. He was the only Englishman who had a thorough personal acquaintance with Western China.

MAJOR SLADEN said, that, having attended the meeting without notice or preparation, he did not then feel himself in a position to say all that he desired on the subject under discussion; but he would gladly avail himself at some future time, if the Society so willed it, of an opportunity of relating his own experiences in South-Western China. He believed that he, and the expedition party with which he was associated in 1868, were the first European travellers who had ever penetrated that hitherto forbidden tract of country which separates Burmah on her north-eastern frontier from the south-western provinces of China. He had it on the authority of Father Abbona, a Roman Catholic priest, who had resided at one or other of the capitals of Burmah for more than thirty years, that Bishop Cheauveau, whilst a missionary in Yunnan, had on three different occasions tried his utmost to cross over from that province to Burmah, but never succeeded in doing so. The expedition which he (Major Sladen) accompanied in 1868 proceeded from Mandalay by water to Bhamo, on the Irawaddy, and from thence, crossing the Kachyen Hills (a belt forty miles in breadth), descended into that portion of Yunnan known in Burma as the Northern Shan States, but in reality a dependency of the great Chinese empire. Thus a land-journey of 50 miles from Bhamo, on the Irrawady (*a point to which the river is navigable for steamers of four feet draft all through the year*) brought us within the confines of the great Celestial empire. The Kachyen Hills had always been represented to be an almost impassable barrier to anything like intercommunication between Burmah and China: not only by reason of physical difficulties, but on account of the alleged hostility of the hill-tribes which inhabit them. His experience quite falsified all such representations. His party found the hill-tribes, as well as other races with whom they were brought into contact, practicable in all respects, when fairly dealt with or free from the influences of contiguous native governments. A very interesting portion of Mr. Cooper's paper was that which related to the Mahomedan Chinese conquerors of Yunnan. It was by *their* assistance and active co-operation alone that his party was enabled to cross over from Burmah to China. They took up arms in behalf of the English Expedition, and fought a way for them through the fortified passes of Mauphoo. They were afterwards their guests for six weeks at the Chinese walled city of Momein, and had ample opportunity of testing their friendliness of disposition, and the earnest desire they evinced of entering into commercial relations with British Burmah. It was a fact of the greatest importance to the British commercial world to know that these Mahomedan Chinese looked to us as a people who would help them to re-establish the old overland trade-route between Burmah and China. Burmah would thus become a highway for our piece-goods trade with Central and Western China, and much of the still undeveloped produce of that vast empire would find a cheap and easy exit down the Irawaddy into the Bay of Bengal, instead of being taken thousands of miles to the eastern seaboard of China, from whence, in order to reach a European market, they would be subjected to the dangerous navigation of the Chinese seas, to heavier insurances, and to a comparatively much longer sea-voyage, than if brought down the Irawaddy and shipped away from the Port of Rangoon. The Irawaddy was navigable for river-

steamers, at all seasons of the year, to a point within 50 miles of the Chinese frontier; and this one fact alone, when properly comprehended, would undoubtedly in time, in spite of opposition or conflicting interests of whatever nature, mark it out as a means of revolutionizing in part our present imperfect attempts to reach the great producing districts of Central and South-Western China.

Dr. BARTON said the first exploration up the Yang-tsze-Kiang, undertaken by Capt. Blakiston, Colonel Sarel, and himself, in 1861, reached as far as Ping-shan. There they found that the southern bank of the river formed the northern boundary of Yunnan, while the opposite bank of the river formed the southern boundary of Sz-chuen. He had not, however, seen any map on which these boundaries were correctly marked. The expedition was accompanied by several Sikhs, and they received every assistance from the Mahomedan villagers.

The CHAIRMAN stated that, within the last few days, fresh intelligence had been received from Bishop Cheauveau by way of China, all attempts to communicate with him overland from India having failed. He had sent a manuscript map, containing much information regarding that little-known frontier country. Since Major Sladen's expedition, our Indian Government had taken a great interest in the question of opening up a route from Burmah to the Western Provinces of China; and, had it not been for the Mahomedan insurrection in Yunnan, no doubt a commercial route would have been established by this time. But, notwithstanding these disorders, caravans continually passed between the two countries, and only recently he had received information that Captain Strover and Major MacMahon had endeavoured to obtain permission to accompany one of these caravans from Bhamo to Momein. It was satisfactory to find that English officers on the spot were looking out for any opportunity that might occur, so that the way might be kept open.

Mr. COOPER stated that Bishop Cheauveau told him he had on three different occasions unsuccessfully tried to send messengers across from Sz-chuen to Burmah, but he himself had never made the attempt. A better class of people than the Mahomedans, as a small community, could not be found in China. Their character was quite at variance with the ordinary Chinese character, as they were brave and enegetic, qualities unknown in other parts of the empire. The proper boundaries of Yunnan and Sz-chuen were marked in a map published by Wyld so long ago as 1837. The trade-route in former days was from Tali-foo to Momein, and thence through to Bhamo; but there were originally three routes,—a northern, a central, and a southern route,—each of which was guarded by separate clans, and the most fruitful source of danger and loss to the caravans was the jealousy of those tribes. He hoped that sooner or later English piece goods would find their way up the Irawaddy and into Yunnan by the route spoken of by Major Sladen, but he never expected any trade to be carried on by the Brahmapootra route, beyond that in Assam tea.

Mr. MICHIE said that for about 150 years all our geographical knowledge of these countries was obtained from Jesuit missionaries, and it was only within the last ten years that other observations had been made, but these had already led to most valuable results. Last year Baron Richthofen made a very important journey from Canton to Pekin, and he had described a coal-field in Shan-si, exceeding in magnitude that of Pennsylvania. He calculated it was capable of supplying coal to the whole world for thousands of years to come. In the event of a railway being made into that part of the country it would have to be tunnelled through the heart of this vast coal-field; but so defective were the means of communication in that province that the coal, which cost a shilling per ton at the mines, at a distance of 30 miles cost 24*s*., and at 60 miles cost 42*s*. Beyond that distance it is of no use at all, in *consequence of the* excessive price required for it. While such enormous coal-

fields were lying idle, the inhabitants had ruined their climate by cutting down their forests for fuel. The Baron intended to have made a return journey through the north-western provinces, so as to make a complete tour of the country, but he was prevented from doing so by the state of feeling in the country after the Tientsin massacre which occurred last June. It was manifest that it was of extreme importance to geographers to know what was the disposition of the people towards foreigners, and an impression appeared to be prevalent in some quarters that there was a general hostility on the part of the Chinese towards Europeans; but, though he had had considerable experience among them, he had never detected the hostile feeling, and, as far as he had heard, travellers and explorers had, as a rule, met with nothing but civility from the people. If the policy of England was founded upon a false hypothesis, it was of the greatest importance that the truth should be known; and he therefore wished to inquire what Mr. Cooper's experience had been on this point.

Mr. COOPER said he lived a year among the Chinese as one of themselves, and in no single instance did he experience from the people the least molestation. On the contrary, the only difficulties he encountered, and the only harsh treatment he met with, were direct from the mandarins. On one occasion he suffered five weeks' imprisonment and a good deal of starvation at the hands of a mandarin. The present relations of England with China seemed to be very much like that of a pan of water, with a hole in the bottom, set on a fire. It was quite a mistake to imagine that the official classes were doing their best for the country. If the Governments of Europe could only appreciate the utter corruption, the absolute want of energy, and the base cowardice of the ruling class, they would act quite differently from what they did at present. If the political and governing classes could be removed, China would become a free country, and her immense resources would be fully developed.

Mr. W. LOCKHART said he had been told that the mother of Bishop Cheauveau was an Englishwoman, and this would account for his intimate knowledge of the English language. The province of Yunnan was remarkably rich in its mineral products. It was the great source of the mineral wealth of China, and even gold was found in the upper part of the stream of the Yang-tsze-kiang. There was, however, no such thing as a white copper mine. That which was called white copper was a compound metal, melted from various ores. The reason why Yunnan was celebrated for its opium was because it was so near to India, and the people had adopted, in part, the Indian mode of cultivation. The cultivation of opium was spreading rapidly throughout the upper valleys of the Yang-tsze-kiang, but it had no connection with the importation of the drug on the coast. There could be but little doubt that the Mahomedan rebellion had been so successful in consequence of the trouble the Chinese Government had with the Taeping rebellion, which prevented their putting forth their strength against the outlying tribes. These Mahomedans were an energetic race, and their doctrines had spread throughout the western regions and a large part of Mongolia. Many Mahomedans were also to be found in Peking. When the present race of the Chinese people overran the country, the aboriginal inhabitants of the south-western provinces were driven into the mountainous districts, and also beyond the boundaries of the continent into the islands of Hainan and Formosa; and very probably the various tribes of the Miau-tsze were the descendants of these aborigines.

Tenth Meeting, 24th April, 1871.

Major-General Sir HENRY C. RAWLINSON, K.C.B., Vice-President, in the Chair.

Presentation.—*E. C. Taintor, Esq.*

Elections.—*G. E. Bell, Esq.; Staff-Commr. Charles Burney*, R.N.; *Walter J. Ellis, Esq.; J. C. W. Paul Graham, Esq.; Simon Little, Esq.; Henry Syme, Esq.*

Accessions to the Library from the 27th March to the 24th of April.—'Barometer Manual.' Board of Trade. Compiled by R. H. Scott. Donors the Board of Trade. 'Gesammelte Naturwissenschaftliche Vorträge.' Wien, 1871. Purchased. 'Bijou Gazetteer of the World.' 1871. Donor the author. 'Travels in Central America.' By A. Morelet. Translated by Mrs. M. F. Squier. 1871. Purchased. 'The Chinese Classics. Vol. III. in four parts. Translated by James Legge. 1865. Donor C. Morrison, Esq. 'Observations on Santorin.' By K. v. Fritsch, W. Reiss, and A. Stübel. 1867. Purchased.

Accessions to the Map-Room, since the last Meeting of March 27th.—Stanford's large Map of the Seat of War, between France and Germany; sheets No. 12, 13, 14, 15, 16, 17, viz. 6 sheets. Presented by the publisher. A tracing of a Sketch Map of the southern and eastern parts of Thibet, as used by Catholic Missionaries. From the India Office. Admiralty Charts, on 11 sheets, completing the publication up to this day.

The following Letters from Mr. R. B. Shaw to Sir Roderick I. Murchison were read:—

"My dear Sir, "Camp, Peshâwur, Dec. 8th, 1870.

"Though I am not yet able to send you such a report of the results of my late journey to Yarkand, as I hope to do when I have had leisure to compare together my notes, to calculate out my observations, and to complete my map, yet I think you would wish to be informed of my return to India.

"Mr. Forsyth and the rest of our party returned some time ago. But on our journey back I was detached from the expedition for the purpose of examining the country lying between the old and the new routes from Yarkand to Ladâk; that is, the country between the high table-lands at the head of the Karakash River and the valley of the Upper Shayok River.

"It is extremely interesting ground to visit; being the westward edge of the series of elevated plateaux which, supported as it were on the summits of the Himalayan chain (using this term in its widest sense), extend eastward beyond our knowledge.

"I found the ground which I had come to examine resembled, on a vast scale, the edge of an embankment which has been much cut up by rain. You are travelling over rolling plains and rounded mountains which, although

attaining 19,000 and 20,000 feet of elevation, are but little higher than those plains. By a scarcely perceptible ascent you reach a low pass, or rather *lip*, and look down on the other side. Your eye is met by a scene of indescribable confusion. High peaks, vertical precipices crowned with glaciers, a labyrinth of dark gorges and narrow chasms sloping steeply away from your feet; these replace the plains behind you. It is like standing on the leads of some immense roof, and looking through an opening down into the maze of pillars and arches of a Gothic cathedral.

"In point of fact, the high plateau which I have mentioned is edged by a huge wall of limestone mountains. This wall, placed like the masonry revêtement of some gigantic embankment, has in a great measure protected the ground behind it from the excavating action of rain and snow which it has itself suffered. The clouds which drift up the course of the Shayok River and its feeders, are arrested by that phalanx of mighty peaks, and expend all their powers on their gradual destruction. It is certain that while deep and precipitous gorges, watered by foaming torrents, abound on one side of the watershed when rain and snow fall; on the other, where vast plains extend, the unguided traveller may wander for days in search of a pool of water to sustain life.

"So much has this limestone range suffered from erosion, that further to the north-west (in which direction it runs) the forces of rain and snow have pierced right through it and beyond it, working into the softer and higher ground behind, which they have bevelled off (as it were); so that we then find a slope which discharges the scanty waters that reach it into the open mouths of the gorges westward, through which they find their way down to the Shayok, swollen as they pass, by many a glacier torrent. These streams, originating on the plateau, traverse, therefore, the entire width of the range, entering at one side and passing through to the other.

"It was, however, at a point where the real watershed pretty nearly corresponds with the crest of the limestone range (if you can imagine a crest banked up to the brim by the plateau on its northern side) that I first attempted to find a route down to the Shayok. After descending but a short distance from the edge of this plain, I entered the upper mouth of a valley which narrowed into a chasm, and presently became a mere crack no wider than an easy ice-crevasse. The walls, which were at first vertical, presently overhung, forming for miles together a sort of corridor, of which the roof was often so low as to oblige one to stoop, while the floor consisted of opaque white ice, the stream having become solid. A gloomy light was all that penetrated between the overhanging walls, varied by an occasional glimpse of the sky.

"After several miles of this wonderful passage, we reached a place where fallen rocks, jammed between the side-cliffs, had formed an obstacle over which in summer time a cascade probably pours. Now the water was all frozen, and we were able to descend. The baggage had to be let down by ropes to successive stages, where the porters were stationed to receive it. It seemed like descending into a mine, so dark were the caverns through which we finally emerged at the foot of the frozen waterfall.

"This process had to be repeated several times, at fresh cascades; until at last an elevation was reached so low (about 15,700 feet, or the height of Mont Blanc) that the stream ceased to be securely frozen, as it was higher up, and the laden porters began to sink, often breast-high, into the slushy mixture of sharp cakes of ice and half-frozen water (the effect of repeated freezings and thawings). The ice-cakes cut them like razors, dyeing the whole surface of the slush with blood. At last the suffering produced by this and by the intense cold of the half-frozen mass proved too much for them, and with one accord they lifted up their voices and wept, or rather howled, declaring that they were quite content to die where they were, but further they could not go.

After wading on for some few yards, I found a small beach or bed of shingle, produced by the stones which in spring are brought down a kind of 'couloir' in the rock above. This being the only choice of a resting-place between the vertical cliffs and the icy stream, I landed here, but had some difficulty in making the coolies venture again into the ice, from a small rock on to which they had clambered. It was only by holding up a bottle of rum before their eyes that I induced them to perform that icy journey of ten yards; but when they arrived the spirits soon stilled their sobbing for a while. Several times during the night we were awakened by the clash of falling stones, which flew over our heads into the stream. The men were all huddled together for warmth, moaning and sobbing with the pain of their frost-bitten limbs, and in the morning they absolutely refused to proceed. In fact, I found that we were at the bottom of a chasm like that of the Via Mala on the Splugen. As long as the stream had been frozen we could pass along. But where it ran free and of unknown depth through this narrow rent, there was no pathway or foothold for us, for a couple of thousand feet upwards, of cliff, on either side.

"We had therefore to return, losing three days in this exploration. So narrow was the gorge, that I returned dry-footed by straddling across the stream, and resting my feet on the firmer edges of the ice when it was frozen against the vertical rock. We had now been three days without fuel; the men sustained themselves by munching uncooked flour and parched barley, and by eating the raw flesh of some of the sheep which we had brought with us. I was more fortunate, having a spirit lamp, with which also some tea was made for the whole party.

"Having got back upon the high plateau, we now attempted a more westerly route, and at the end of the second day's march through interminable valley-plains, discovered a lovely little blue lake, half frozen and covered with wild-fowl. From near this lake we obtained a view westward along a magnificent avenue of snowy mountains, one range on either hand. Far away in the distance they seemed to come together at last, leaving only a narrow pass between two of the highest peaks, one belonging to either range. I concluded that this apparent pass would be the watershed; as between us and it there was nothing but an undulating plain. What was my astonishment, after walking a few yards, to find some water trickling westwards *towards* the mountains. I had, therefore, already passed the imperceptible watershed between the great river-systems of the Indus and of Central Asia. Beyond the lake we had just passed, the waters feed the Karakash, the 'Jade River,' which flows through the Kingdom of Khotan into the great central desert of Gobi, while the trickling stream which I had reached pierces the great lime-stone range, and much augmented on the way, runs through rocky gorges into the Shayok, which is one of the chief sources of the Indus.

"Thus the great water-systems of Southern and of Central Asia are here separated by no gigantic mountain range, but merely by a few yards of level sand; at a prodigious elevation, it is true.

"I need not detail the trouble we experienced in following down the stream which we had just struck, through the narrow gorges which it traverses after entering the mountains we had seen in the distance. Through these mountains we followed it until it reached the great Shayok River. The upper course of this river is of the utmost interest, being the scene of the great *débâcle* of 1841, when a lake, formed by the glaciers near its head, suddenly burst, and swept down the valley into the Indus. It still continued, carrying havoc and destruction in its course, till it reached the plains, and swallowed up a great part of the Sikh army, which happened to be encamped on the banks of the river as far down as Attock, 800 miles from the glacier!

"In the year 1869, on my first return from Yarkand, I had seen the traces

of this temporary lake above Sassar. The marks were visible 200 feet above the level of the stream, and extending for ten or a dozen miles up the widening valley above the narrow bend, where a huge protruding glacier even then seemed threatening to close the exit. Thus the calculations of General Cunningham regarding the size of the lake, founded on the records of the height attained lower down by its escaping waters, are signally verified.

"On the present occasion (1870) I followed the Shayok down into Noobra, over a scene of desolation quite indescribable. Wide terraces of gravel had replaced the pasture-grounds which formerly occupied the sides of the stream. In its tortuous course, it is so frequently washed against opposite sides of the valley, that we had to ford the icy stream, 3 or 4 feet deep, more than forty times in the course of the eight days which were occupied in descending it. A month later, it is hard-frozen, and forms the winter high-road of Yarkand commerce. But I believe no European has followed its whole course before (none having passed a winter there of late); nor visited its source,—a vast sea of blue glacier which, descending from some enormous peaks, spreads out upon a wide plain at their feet, forming a real *mer de glace* of unequalled expanse and beauty. I have also had the satisfaction of fixing the actual position of the cataclysmal lake before referred to, which has been a subject of much conjecture; and of disproving the existence of the glaciers lower down the Shayok, which had been supposed to have caused its formation. The glaciers seen by Thompson above Sassar (or rather the upper one of the two, which I fancy he cannot have visited) were the real cause of the disaster.

"But the most interesting discovery has been that of the fact that the so-called Karakoram *Range* is no range at all in any correct sense of the term, to the eastward of the Pass of that name. (To the west of the Pass it is more correctly called the Mustak Range; no native ever applies the word Karakoram to anything but the Pass itself.) There is no continuous ridge dividing the waters of Southern and of Central Asia. The Karakoram Pass is the *lip* of an elevated plateau; situated, it is true, among enormous mountains, but not coinciding in any way with their axis. Further east and south, on the high table-land of Lingzee Tung which I have been describing, the head-waters of various streams interlock in the most marvellous manner on the open undulating plain, with no high ground to divide them. A stream which begins by flowing east towards China will finish by running west into the Shayok and Indus; while, within a few hundred yards, you will find two parallel brooks running in opposite directions. In this concatenation of waters, a man who should undertake to walk along the watershed would find himself describing the most extraordinary curves, facing alternately each point of the compass, and often retracing his steps almost.

"Farther east again, to the north of Chang-Chenmo and Roodok, a distinct ridge seems to divide the waters. But this ridge is apparently only the continuation of what I have called the Limestone Range. This range, running S.E. and N.W., ceases for a while to be a watershed. It is pierced by the Shayok and its feeders in the neighbourhood of the 35th parallel of N. lat. (the former river piercing it through that narrow gorge which was choked up by the Koomdân Glacier).

"Beyond this (still going north-westwards), it divides the sources of the Shayok from those of the Noobra rivers, and unites with the Mustak Range nearly half a degree west of the Karakoram Pass, probably forming by its junction that very knot of gigantic peaks which give rise to the Shayok *Mer de Glace*.

"This range, which in one place divides the Indus waters from those of the northern plains, which farther on is itself pierced by the Shayok, and which finally separates the two Indus feeders (the Shayok and Noobra) is evidently the true continuation in direction of the Mustak Range. But the fact

that the watershed of the Shayok lies beyond it, and that it is pierced by a large river (a thing which it has in common with most of the Himalayan ranges) has concealed its true unity, and given rise to a supposed Karakoram range, running round the heads of the Shayok feeders in a continuous mountain chain; diverging from the former direction of the Mustak so as to form a huge bay, and then resuming it in a somewhat unnatural manner.

"The idea of a Karakoram Range, dividing the two water-systems, east of the meridian 78° E., should, I think, be abandoned.

"ROBERT B. SHAW."

"MY DEAR Sir, "Lahore, Feb. 20th, 1871.

"The accompanying letter was begun more than two months ago, immediately on my return from Yarkand, and when I was at Peshawar, in the camp of the late lamented Sir H. Durand.

"My writing was interrupted by a dangerous seizure of illness (rheumatic fever), consequent on my exposure, &c., up the Shayok. I have only just recovered, having set up my health by a resort to the warmer climate of Calcutta, where Lord Mayo was kind enough to invite me to stay with him.

"I think the accompanying short description of my little exploring trip will not have lost whatever interest it may possess by the delay. I therefore take the liberty of enclosing it, although so late.

"I have just been appointed to the post of British Commissioner in Ladâk, and there hope to have many opportunities of furthering geographical science.

"I should be very grateful if the Geographical Society would permit me to purchase the instruments which were granted to me on loan before my recent journey.

"I fear my full report must be delayed for some time yet, everything having been thrown into arrears by my illness. But I now have the pleasure to send herewith copies of my observations for latitude, longitude, variation of the compass, and altitude by boiling-point, also a map illustrating my letters. I trust this may prove of some interest. The lunars are, of course, the first direct observations for longitude that have yet been made in Eastern Turkistan

"With my best wishes for your speedy and complete restoration to health,

"ROBERT B. SHAW.

"P.S.—I have brought back a complete set of specimens of all the strata and rocks which occur between Turkistan and the Indus, including some containing fossil remains of shells. I have also notes of the order, succession, and dip of these several rocks. If this collection were thought sufficiently interesting, I should be happy to send it home."

"MY DEAR SIR, "Lahore, March 18th, 1871.

"I have now the pleasure to send you copies of my observations for latitude, longitude, height, and variation, which I regret were not ready in time to send with my former letter.

"With reference to the subject discussed in that letter, viz.:—the Limestone Range, pierced by the Shayok and its tributaries, I have just come across a singular confirmation of what I advanced, in the travels of Dr. Thomson ('Western Himalaya and Tibet'), a book which I had not seen for some years. The following passage (chap. xiv.) refers to the view obtained on reaching the high-level plain of Debsang (so marked in my sketch map):—

"'By degrees, as I increased my elevation, superb snowy mountains came in sight to the south-west; and, on attaining the top, an open, gravelly, some-

what undulatory plain lay before me, while *behind me a grand snowy range was seen* in perfection, forming apparently a continuous chain, with a direction from south-east to north-west. The snow was to the eye perfectly continuous in both directions, as far as the mountains were visible. . . . As I had passed through this *apparent chain* without rising above 16,000 feet, the continuity of the snowy mass was, of course, a deception.'

"This is the chain which I have ventured to assert to be the real continuation of the Mustâk Range, eastward, although it is, as Dr. Thomson observes, broken through in several places by the Shayok and its tributaries, through narrow gorges. Dr. Thomson also describes this chain, where he passed through it, as being composed of 'greyish massive, but brittle limestone,' exactly the same formation which I found in the eastern prolongation of this range near the Lingzee-tung (or plain), and which I also found to be the composition of the cliffs to the west, where the Shayok escapes through the gorge of the Koomdân Glaciers.

"I should be very much obliged if I could be informed of the result of my observations, when calculated.

"ROBERT B. SHAW."

The following are the results of Mr. Shaw's observations for the Longitude of Yarkand, as computed by Mr. W. Ellis, of Greenwich Observatory.

LONGITUDE OF YARKAND.

(*From Observations by* R. B. SHAW.)

I.—OBSERVATIONS FOR LOCAL TIME.

September 1, 1870.

Object observed.	Number of Altitudes.	Watch Time. H. M. S.	Error of Watch on Yarkand Mean Solar Time. M. S.
Sun	2	5 27 55	10 3 slow.
a Aquilæ	2	7 27 35	10 17 „
a Lyræ	5	10 27 22	10 39 „

II.—OBSERVATIONS OF LUNAR DISTANCES.

September 1, 1870.

Yarkand Mean Solar Time. H. M. S.	Distance Measured.	Number of Measures.	Longitude East. In Time. H. M. S.	In Arc. ° ′ ″
5 37 48	Sun to Moon ..	3	5 7 42	76 55 30
7 42 6	*a* Aquilæ to Moon	5	5 10 16	77 34 0

The Sun was to the *west of the Moon*, and *a* Aquilæ to the *east of the Moon*.

The mean of the two results gives for—

LONGITUDE OF YARKAND.

In time, 5h. 8m. 59s. east of Greenwich.

In arc, 77° 14′ 45″ east of Greenwich.

The latitude of Yarkand adopted in the calculation of the above results was 38° 24′ 30″ north.

WILLIAM ELLIS.

GREENWICH, *April 24th*, 1871.

Mr. Markham then read the following Paper :—

Report of the Mirza's Exploration of the Route from Caubul to Kashgar. Drawn up from his original Journals, &c., by MAJOR T. G. MONTGOMERIE, R.E.

[EXTRACTS.]

THE explorer, designated in the report as the Mirza, was directed to carry on an exploration in Central Asia. After several unsuccessful attempts and many delays, he finally started for Badukshán on the 10th of October, 1868. He crossed the Hindoo-Koosh range by the Hajiguk, 12,000 feet above the sea, and passed on to Bamian and Khulm. From Khulm he proceeded to Rostak, and thence to Faizabad. Faizabad is the capital of Badukshán ; it runs for about a mile along the right bank of the Kokcha River, and is nowhere more than half a mile in breadth ; it has no walls, and its inhabitants are chiefly Tājaks and Turks, but they have not Tartar features. Here the Kokcha River has a rocky bed and a deep rapid stream. It has three sources, the 1st from the Hindoo-Koosh mountains above Zebak ; 2nd, from the Jerm Valley ; and, 3rd, from the small lake of Bazghiran. The combined stream falls into the River Oxus (the Amoo Darya) about 35 miles west of Rostak, at a place called Dast Tārā Tuppa. The trade in slaves is still very great in and around Faizabad, the serais and houses being full of slave girls, who have mostly been procured from Chitrál ; horses and goods are given in exchange for them.

The inhabitants are skilful in smelting iron, and they send a number of cast-iron pots, pans, ornamented lamps, &c., to the market.

The Mirza stayed at Faizabad a short time in order to take his observations, and at the same time to change his ponies, arrange as to guides, &c. His men were very unwilling to assist, the stories they heard as to the Khirghiz robbers and the cold of the Pamir Steppe making them very averse to a further advance. The Mirza however, persisted. He applied to the Meer or ruler of Badukshán for permission to go by Kolāb ; but he refused to give it, as the road, though the snow had melted, was still very unsafe. The Meer, however, said he thought the Mirza might now be able to go by the Pamir Steppe, and if he wished to do so would recommend him to the protection of the Governors of Punja and Sirikul whilst in their territory. Hearing that the Khirghiz hordes had probably withdrawn from the Pamir Steppe, the Mirza determined to accept the offer.

The present Meer of Badukshán, Shandar Shah, is about forty years of age; he has decidedly Tartar features, with small eyes and a scanty beard. He is given to drinking, and allows his petty officials to do very much as they like: he is consequently unpopular.

The Mirza found that, although he had the Meer's permission, his difficulties as to starting were by no means at an end. Throughout his journey various individuals had pretended to be acquainted with him, to know what he was going to do, &c.; and at Faizabad he had to quiet one man who threatened to denounce him as an infidel (Kafir) that was spying out the country for the Feringees, &c.

After a great deal of delay and anxiety the Mirza succeeded in starting on the 24th of December, 1868, and followed the right bank of the Kokcha River. The road was very bad and mostly unfit for riding, but the country round about was very well cultivated and evidently fertile. After five marches they reached the small village of Zebak, from whence there is a road to Chitrál. This route is said to be dangerous on account of the inroads of Siyaposh Kafirs; but still a considerable traffic is carried on by this route between Badukshán and Chitrál. The Mirza heard a great many stories about the Siyaposh and other Kafir tribes, agreeing generally with the former accounts given of these strange people, who have succeeded in maintaining their independence in spite of their warlike neighbours in Afghanistan, &c. Though the children of the Siyaposh Kafirs are in great demand as slaves, and many are carried off by force, whilst others are sold voluntarily, still the number of these people does not seem to have diminished, and it must be concluded that the percentage carried off is not very great. At Zebak the Mirza parted with his guides, as he found they were constantly trying to frighten his men with stories as to the dangers and difficulties of the road. Abdul Wahab, whom he had made Kafila Bashi, said he could get on quite well with his own men, and the Mirza left Zebak on the 1st of January, 1869.

After crossing a pass, and subsequently a river coming from the Chitrál direction, he reached Aishkasim Fort on the Punja or Upper Oxus River. Aishkasim may be considered to be the beginning of the Wākhān (or Wākāh) Valley. The country round about is very fertile, and crowded with villages.

From Aishkasim to Punja the road was but a badly defined path, running up and down the intervening ridges—a route difficult in every way. Several villages were, however, met with, and the party got over it without much difficulty, though suffering a good deal from the cold. The Upper Oxus River was frozen so hard that it could be crossed at any point. The river is said to be in this state

from December to March, and during the rest of the year it is dangerous to ford. This latter circumstance is undoubtedly one of the main reasons on account of which the winter is often chosen by merchants for crossing from Badukshán to Kashgar, and *vice versâ*; the other cause, and possibly a more potent one, being that the snow and cold induce the Khirghiz hordes to remove their cattle and sheep to lower ground, and there is consequently less chance of a Kafila being plundered.

Having completed his preparations, the Mirza left Punja on the 8th of January, 1869, and marched on to Patoor, the last village of the Sarhad Wākhān or Wākhā Valley. At Patoor it is necessary to purchase supplies for the onward route, not a thing being procurable for the next eight marches, whether the Kashgar or the Kokan route is taken; any neglect as to a proper supply of provisions is likely to be fatal. The road to Patoor was a bad one, running through a very narrow defile crossing the frozen Oxus several times during each day's march. In summer this route is said to be impassable. As far as Patoor, for 42 miles from Punja, the country, though not very fertile as to crops, is well peopled, and there is no difficulty about good halting-places near villages. The extreme cold was the only hardship.

The Sarhad Wākhān Valley is bounded on the north and south by high ranges of hills, and up as far as Patoor the lower slopes were still covered with flocks and herds.

Ten miles beyond Patoor, near Lungur, the high hills gradually close in and soon leave but a very narrow gap for the passage of the river; farther on, the high northern hills merge into the comparatively low hills or knolls of the Pamir Steppe. The wealth of the Wākhān Valley mostly lies in live stock in sheep, cows, goats, ponies, and yaks: the wool from these animals is worked up partly for domestic use, but mostly for export, being exchanged for other goods. The people all wear thick woollen chogas and trousers, the cold being intense. Their houses are built of stone and mud with a flat roof. Each house has a large stove, or oven as the Mirza calls it, in one corner, in order to keep it warm, and this it does thoroughly. The houses are generally built touching one another.

The inhabitants of Wākhān are generally Shiá Mohamedans, looking to Agar Khan of Bombay as their spiritual guide. They are said to pay him annually one-tenth of their income. The Mirza says that they complain very much of their own chief's oppression.

On arrival at Patoor the Mirza's first care was to make sure of the services of the new guide, Peer Ali, who had been ordered by the Meer to take him across the Pamir Steppe: this he succeeded

in doing by making the man a present of a good warm choga, and by giving his small son a handsome present in money. The Mirza then proceeded to lay in provisions to carry his party over the Pamir Steppe. Nothing in the shape of butter (ghee) could be got, so he bargained for and bought some fat sheep of the doomba or large-tailed kind; these he had killed, and the carcases were carried on the ponies just as they were, to be expended as required, the extreme cold being sufficient to prevent all anxiety as to the meat keeping. Some flour and a few smaller things were added; a supply of dried fruits and sugar-candy, &c., had been laid in whilst in Badukshán. Everything being ready, the party resumed its journey: starting during a heavy snow-storm, they trudged along up the Wākhān Valley. The wind was so piercing, even after the snow stopped, that the men had frequently to get on the lee side of their horses, so as to keep it off a little. For the first three marches the path ran between a number of villages; the lower part of the river-banks being covered with a dense growth of stunted willows, as the Mirza calls them—most probably the Myricaria. At the fourth halting-place a road strikes off to Chitrál by Mustūch (or Mustuj).

Mustūch is said to be a valley draining into the Chitrál or Koonur River; the road to it from Wākhān is said to run for the most part through well-peopled mountains. The route is a short one, being about 15 marches to Chitrál, and, though much snow falls on the pass, the traffic along the route is considerable. Mustūch lies to the south of Wākhān; it is nominally independent, but its chief has to send an annual tribute of slaves to Badukshán—a fact which shows that the communication between the two countries is tolerably good. At this same halting-place a more direct road leads over the mountains to Lungur by what is called the Marpech, or zigzag road.

The Mirza avoided the Marpech road, as it was pronounced to be very difficult and dangerous during the winter, though it is used in the summer when the road along the river is impassable owing to the floods. The Mirza pushed farther on up the branch of the Oxus, for 4 miles; the path was either on the frozen river or on its bank, passing through a very narrow ravine walled in on either side by stupendous and all but inaccessible mountains. These mountains were very imposing, being clad with snow almost down to the river, and leaving hardly 10 yards of level ground on either side.

The real difficulties of marching across the Pamir Steppe may be said to commence on the fourth day beyond Punja; the marches are long, and there is no shelter of any kind to be got except the

dry stone walls, which previous travellers have run up in order to keep off the piercing wind. On the sixth evening the party arrived at the halting-place called Lungur, from whence a road strikes off to the Kunjūt or Hunza territory, which lies to the south-east. Lungur is considered to be the beginning of the Pamir Steppe; the halting-place has the usual dry stone walls, but they, unfortunately, had been taken possession of by the camp of an agent or vakeel of Shandar Shah's, who was going on some business to Kunjūt. Seeing that the only shelter available was occupied, the Mirza only stopped a few hours at Lungur, to collect fuel for the forward march. Having laden their ponies heavily, they started on again, but were not able to make much progress before evening; they halted near an isolated rock, which afforded a little shelter from the wind. The whole party suffered a good deal from "Dum," as the Mirza calls it—*i. e.*, shortness of breath, &c.—the usual effect at great altitudes. The natives generally consider this to be caused by a noxious wind. Some of the men became nearly insensible, but soon got over it when they had eaten a little dried fruit and sugar, which the Mirza served out as soon as he saw the state of affairs. The night spent at this sixth halting-place was a miserable one, owing to a fall of snow, and in the morning the men literally rose out of a bed of snow. The great cold had made both the men and ponies very sluggish, and the horses were several times affected by shortness of breath; the Wākhānis, however, soon relieved them by bleeding at the nose. The next march brought the party to the ruins of what had formerly been Khirghiz huts, which had been abandoned in consequence of incursions made by Kunjūti robbers. From this point there is a good road to Gilgit and Kunjūt. The night at this halting-place was, if anything, more trying than the last. The next morning they started early, and, relying on Abdul Wahab's two young men, they trudged along for 9 miles, and were then suddenly brought to a standstill, owing to their having lost the track, which had been obliterated by the fresh snow.

The mountains from Lungar had sloped off into rounded hillocks, and generally became so open that the travellers were not at all certain as to the route they ought to take. The party now found themselves in an open valley some 4 or 5 miles wide. In it the Mirza made out a small frozen lake, which he estimated to be about 2 or 3 miles in length; but owing to the snow it was, of course, difficult to decide exactly as to where the lake ceased and the land began. A frozen stream issued from the western end, being, in fact, one of the sources of the Punja branch of the Oxus.

The small valley was bounded on the north and south by craggy hills, rising up suddenly from the level ground. These hills are the summer haunts of both the Kirghiz and the Kunjūti robbers, who have temporary huts concealed in various places. It was a great trial to the party to be in doubt about their road in such weather and such a desolate place; the men scattered to search for the track, but the fresh snow made it a difficult task. The men's boots, made of thin, spongy leather, had sucked up the moisture and then had frozen, thus making all walking about very trying.

The men had to lie down in the snow, passing another wretched night. The party marched on again the next morning as soon as they could see. For about 3 miles the track appeared to run along a frozen stream that issued from the east side of the lake, and to flow in an easterly direction. Owing to the snow, the Mirza is not quite certain of this, though positive that there was, at any rate, no perceptible rise to the east of the lake. Daylight enabling the Mirza to look about him, he saw that he had at last reached the crest of the Pamir table-land, or, at any rate, of that portion called Pamir Khurd (Little), which is the name of this part of Pamir. The guides said the name of the lake was Pamir-Kul, sometimes called Barkút Yassin, after the halting-place near the lake. The mountains close at hand were comparatively not very high, but further to the north higher peaks were visible, as also to the south in the direction of Yassin and Kunjūt; but the path itself passed out between endless hillocks, and at times there was literally nothing to guide the eye as to which line to take.

The Mirza was now on the backbone or watershed of Asia, the streams to the west flowing into the Sea of Aral, and those to the east into the Yarkund River, and finally into that remarkable depression in the centre of Asia called Gobi, or Lob Nor. He was now at an elevation of about 13,300 feet above the sea. The scene, according to his account, was the most desolate that he ever saw—not a sign of man, beast, or bird, the whole country being covered with a mantle of snow. Though the Mirza and his men were all well supplied with warm clothing—their bodies being encased in woollen chogas and sheepskin posteens or coats, their heads in fur caps, and their feet in two pairs of long woollen stockings, and their boots filled with wool—they nevertheless felt the cold very much. The Mirza, indeed, says that the intensity of the cold was extreme whenever the wind blew, and that they then felt as if they were going to lose their extremities; the glare from the snow was very trying to the eyes, all suffering from snow-blindness; their breath froze on their moustaches; and every one, moreover,

had to walk in order to keep some warmth in the body. The ponies were in a wretched state; for the last few days the poor beasts had to go without water, and to quench their thirst by licking the snow. After a most toilsome march of about 20 miles, the Kafila Bashi chose a halting-place near a frozen pool, hoping to get water out of it both for the men and the ponies; but when a hole was broken in the ice the ponies could not be induced to drink at it, and they had to take to the snow again. Soon after they halted a furious storm of wind set in, and prevented the party from lighting their usual fire, and they could not even make their tea or cook their food, and consequently spent another very wretched night.

The next morning the party followed the Kafila Bashi down the stream, which was now of some size and clearly flowing eastward into Turkestan; they then ascended to the crest of a low spur, from which they had a good view over the great expanse of the Pamir Steppe, which appeared to be a sea of low rounded hills one behind the other, but nowhere rising to any great height above the more level ground. Descending from this commanding point, called Aktāsh, or White Stone, they encamped near the stream. This last march had been a great improvement on the former one; the snow had retired further and further from the track, and they saw signs of animal life in the shape of a herd of some kind of deer which crossed the path: these deer and other game are said to be very numerous in summer. The next day the party again followed down the stream, which was now hemmed in by cliffs on either side; they encamped in a low willow (Myricaria) jungle, and were able to get both wood and grass, and to make themselves and their ponies tolerably comfortable again. The next day, after marching 3 miles, they caught sight of the fertile valley of Sirikul, and, pushing on, were soon under the walls of the Tashkurgān Fort, having spent twelve miserable days between it and Punja.

The party pulled up near a deserted house. They had hardly settled themselves when a number of the Atalik Ghazi's Kirghiz soldiers came and joined them, with a view to find out who the Mirza was; when told that he was a merchant going to Kashgar, they evidently did not believe the story, and soon afterwards went away.

Late in the evening the Mirza was summoned by the Governor of Sirikul, and he accordingly went with the Kafila Bashi to the fort. He found the ramparts and bastions all in ruins, and, after tumbling about in a rugged narrow passage, he was ushered into a very small dark room. Here he had to wait for some time, in no

little apprehension as to what was to be the result of this visit. At last the Governor came in with lights, and the Mirza found himself in the presence of a hale man of about sixty. After the usual compliments, and the discussion of tea with very hard wheat-flour cakes, the Governor proceeded to ask a few questions; and, having heard the Mirza's story, he said he would like to have all the Mirza's khurjīns, or packages of merchandise, opened in his presence, so that he might see what the nature of his goods was. The Mirza was greatly alarmed at this request, lest his concealed instruments should be found in the search. He had fortunately brought some presents with him to the fort, and he at once proceeded to offer them to the Governor, saying that they were specimens of his goods for his acceptance, and that he hoped he would not have the whole of his packages opened out, as he wished to dispose of their contents in Kashgar, where he was taking some things for his friend Nubbi Buksh, a jemadar in the Atalik's service. The presents, and the fact that Nubbi Buksh was in great favour with the Atalik for his military services, made the Governor decide to forego a search. After consideration, the Governor, who is a brother of the Atalik, said he would allow the Mirza to go on to Kashgar, under the escort of a Kirghiz chief called Abdul Rahman; but, in spite of all remonstrances, he would not allow the Mirza to go by himself, still having suspicion of his real business. With this order as to escort, and the return present of a poor choga, the Governor dismissed the Mirza, who went back to his quarters in great anxiety.

Sirikul is a valley bounded on the north by the Chickhik-Dawan mountains, on the east by the rugged chain called Kāndār, on the south and west by the last spurs of the Pamir mountains. The level ground runs from east to west for 30 or 40 miles, with a breadth of 12 to 18 miles. In the centre stands the old fort of Tashkurgān,—a celebrated place, now in ruins, said to have been built by Afrasiab, the conqueror of Persia, as a safe place to deposit his treasure, which is still supposed to be buried within the limits of the fort. The fort formed an oblong, about one mile in length by a quarter of a mile in breadth; the towers and ramparts, of rough stone, were all in a ruined state, and the houses inside were mostly unroofed. Tashkurgān commands the roads from Badukshan and Chitral to Kokhān, Yarkund, and Kashgar, and is still considered a place of importance, the more especially as it gives a control over one of the chief outlets used by the robber hordes of Kunjūt when they issue from their narrow glens.

The valley is watered by the Sirikul River, the main branch of

which is said to come from the direction of the Karakul Lake, or from the lake itself. It is joined by the stream on which Taskkurgān stands, about 5 miles to the north of the fort and some 30 miles farther down by the Kunjūt River, at a place called Charsuton, and a little further on by the river which drains the northern face of the Karakorum Mountains, the combined stream forming the great Yarkund River.

Sirikul, when the Mirza entered it, had been deserted by the greater part of its native population. The hereditary ruler of the country, Alif Beg, whom the Mirza met near Punja flying to Badukshan, had left as the Atalik Ghazi's troops began to take possession. The Atalik Ghazi had directed all who were attached to Alif Beg's rule to be removed to Kashgar and Yarkund, and this included nearly every inhabitant; their place has been supplied by Kirghiz, who seemed to like the change. The former inhabitants were of the Tāj race,—a tall, strong-built set, with good features and fair complexions.

The valley is elevated, Tashkurgān being 11,000 feet above the sea. It produces wheat, Indian corn, &c., which are said to grow well. The whole valley is studded with small square forts, now held by the people of the Atalik Ghazi. The whole valley is well irrigated from its own rivers.

On the 27th January, 1869, the Mirza resumed his march towards Kashgar. At 5 miles from Tashkurgān the path crossed the main branch of the Sirikul River, flowing from the west; though 50 paces wide, the stream was frozen hard. Up-stream, the flat part of the valley appeared to be very narrow; while to the east it was broad and open, evidently very fertile, and extending for a long way down the stream.

After crossing the main stream on the ice, the party followed its bank for about 5 miles more, the road running through swampy ground. Five miles farther on they passed a deserted Kirghiz village, the houses of which all had dome-shaped roofs; near this place the Kirghiz chief Abdul Rahman had taken shelter in the tent of one of his horde. The tent was of the usual Kirghiz kind, called "kappa," made with a portable wooden frame, covered with felts,—a comfortable enough protection in the winter, but not well adapted for resisting rain, which it lets in at every angle.

Abdul Rahman was of pure Kirghiz breed, a square strong built man with a round head, and small blue eyes, without eyebrows, broad flat nostrils and a little stunted hair for a moustache above a bare projecting chin; fortunately he was good natured and anxious to be as kind to the Mirza as he could: he was the chief of a large

horde, and said to be able to muster about 3000 armed horsemen. He and his horde owned great numbers of sheep, goats, yaks, horses, and double-humped camels, which are grazed in different places, according to the season, going wherever the grass is best. The Kirghiz men and women both wear loose wollen chogas and trowsers, with high thin leather boots. The men are ugly, the women somewhat better looking. They are Mahomedans, but not rigid observers of that religion. Snow fell all night, but the tent was so comfortable that the Mirza did not wake till the call for morning prayer was given: he then found the Kirghiz men all sitting round the fire, sipping gruel made with flour; they offered him a share, but he was not hungry enough to try it. The chief rode on ahead, and left a man to guide the Mirza.

As soon as the chief had collected his tribute the party marched on again, the road and country being very much as on the previous day. At the seventh mile the stream which they had followed from the Chickik-Dawan diverged to the south to join the Yarkund river. The road turning to the north led up by a steep slope, then across tolerably level ground, and, descending again, passed a domed house in ruins, called Chahilston, supposed to be on the boundary between Sirikul and Yarkund. Farther on there was a still steeper ascent to a ridge covered with huge masses of rock, then another descent, which finally, after trudging for 23 miles, brought them in sight of a beautiful valley called "Keen," or the Bride, from its general fertility, being a wonderful contrast to the desolate barren tract the party had just traversed. The sight of this valley, with its easy slopes and stream of flowing water, quite put the Mirza and his men into good spirits, and they looked forward to their chances at Kashgar with less gloomy forebodings than they did whilst in a half-frozen state. The country looked altogether more civilized, and the Kirghiz families passed were generally busy spinning wool or weaving.

After leaving this valley the road turned to the north-east over a stony pass, enclosed by great cliffs, then down the ravine coming from the valley, crossing and recrossing the stream repeatedly until the men and horses were fairly tired out, their limbs being stiff with the cold and hard exercise they had been undergoing.

At 28 miles from Keen, or 98 miles from Sirikul, the party got clear of the rugged country, and, turning more to the east, came upon a fort called Karāwal at the entrance of the Chichik-Dawan valley. This was a strong place, completely commanding the road, the ramparts being built on the edge of the cliffs in such a way as to appear inaccessible on all sides except by the eastern and

western gates. The fort appeared to be about a mile in circumference, including a number of deserted houses, only a few being occupied by about 200 of the Atalik's troops, who seemed to be badly supplied, and had the credit of plundering every one that was without a pass from the Atalik or his officials.

Soon after passing Karāwul the hills receded to the west and south, opening out a distant view of the Kashgar and Yarkund territory. The Mirza, following the stream for a time, found himself in a fertile country, all but flat, covered with villages and forts each embedded in large orchards of fruit-trees. Finally he crossed over the Yangi-Hissar River on the ice near the junction of the stream which their road had led them along; the river was about 100 paces in width, and in the summer can only be crossed by the bridge.

Late in the evening the party entered the town of Yangi-Hissar. The Mirza was taken to a house and at once presented with a muslin turban and a pair of boots: when he objected to receive them, the chief said it was the custom of the country, being a mark of hospitality.

The next day (the 3rd February), after passing over two moderate-sized streams, the Mirza, at 13 miles, crossed the great Turwaruk River, with a bed 150 paces in width, by means of a wooden bridge; entering the Yangi-Shahr, or new town of Kashgar, 3 miles beyond the bridge, being 5 miles short of the old town of Kashgar. Between Yangi-Hissar and Kashgar the country was studded with villages, and every piece of available land was carefully cultivated. Shops were met with on the road every now and then, where travellers could buy refreshments in the shape of ready made bread, boiled fowls, hot tea, sherbet, and sour milk, which were always ready at the smallest shops. Every thing was very cheap. Along the road, at intervals of about 4½ miles, the length of one tash (tash meaning a stone) a board was fastened to a pole to indicate the distance from Kashgar to Yarkund. Orchards of fruit-trees, and groves of mulberries, occupied a large portion of the land, which is generally level, the hills in the distance making but little show, except near Yangi-Hissar, where high mountains were visible to the west and south-west, while to the east nothing in the shape of a hill was visible.

The Jemadar soon afterwards rode off to report to the Atalik Ghazi, and before long returned to inquire whether the Mirza had any letter, and the usual presents for the Atalik with him. The Mirza said he had nothing of the kind, and that he was not a vakil, &c., but all in vain: the Jemadar said he must show his baggage,

and forthwith had everything opened out. Having appropriated whatever he fancied, he directed the Mirza to take up his abode in a neighbouring house in the same fort which afforded but miserable quarters, already partly occupied by some Afghans, who had been directed to watch the Mirza closely: there the Mirza passed the night in great anxiety, not knowing how the Jemadar would behave. Next morning the Mirza was taken over to the large fort, and introduced to the presence of the Atalik: he passed a large open building filled with some hundreds of people who were eating, and was then ushered into a small room, where he found the ruler sitting on a carpet, with two or three chiefs around him. The Atalik received the Mirza much more graciously than he expected; welcomed him to Kashgar, asked him a few indifferent questions, and then requested him to go and breakfast with his chiefs in the outer house, where they were all seated round a fire. The Mirza found these officials talking about two English officers who had lately entered the Kashgar territory; they asked the Mirza if he knew them, but he said he did not: they did not speak much, but allowed the Mirza to eat without interruption.

During his residence at Kashgar the Mirza was called before the Atalik on several occasions, in order to ask questions as to Hindustan, Badakshan, and Afghanistan, and also to find out who the Mirza was; but the Atalik did not speak much. At other times the Mirza saw him passing towards the Artush Ziyarat, called Khoja Affāk, where he generally went every Friday.

The Mirza describes this remarkable man as being a devout and strict Mahomedan. His name is Mahomed Yakub Beg, a native of the village of Pishkadh, between Tashkend and Kokhan: he is of the middle size, dark complexion, and is now about fifty years of age. His father was a petty farmer or small zemindar, and he himself started in life as a Peshkhidmut, a sort of private upper servant, or one of the body guards of the Khan of Kokhan: half a soldier, but bound to give personal attendance to the Khan at table, during dressing, while mounting his horse, &c.; his emoluments at that time probably not amounting to more than Rs. 100 a month, paid by the assignment of the revenues of a small village, and by perquisites in the shape of clothes, horses, arms, and so on. From Peshkhidmut he rose to be Dadhkwah, or Governor of Ak-Musjid, a post which he held for about three years, nearly up to the time the Russians occupied that place. He has the credit of having allowed the Russians to settle near the Ak-Musjid fort without the knowledge of the Khan; when this became known to the then Khan, Yakub Beg is said to have run off to Bokhara, the Russians taking the

place soon afterwards. Bribery is supposed to be at the bottom of this transaction; but however that may be, he remained away about three years in Bokhara, and was then taken into favour with the new Khan of Kokhan, Mola Alum Khol, who had lately succeeded to the Musnud, and was made one of his Durbar chiefs, and had the revenue of two or three villages assigned to him. He has received no education, can neither read nor write, though his people declare that at the age of forty-five he learnt his letters sufficiently to read the Koran, which he is said to study every morning: he is very strict as to all rites of the Mahomedan religion, and forbids wine, opium, and smoking; females are not allowed to go about unveiled, and every one is ordered to pray five times a day.

He is a Tajuk, and his native language is Persian, though he now seldom speaks anything but Turkish. At the time of his return to Kokhan he was in no great favour; but on the representation of Walli Khan Tora (one of the chief men at Kokhan), the Khan sent him to assist in driving the Chinese out of the Kashgar territory. Whilst Yakub Beg (now styled Atalik) was engaged on this expedition, Walli Khan Tora tried to set up for himself in Kashgar, but owing to the Atalik's intrigues, was forced to fly to the mountains, where he is said to have been murdered by some unknown person: a fitting fate for the scoundrel, who, besides having the unfortunate M. A. Schlagintweit murdered, was noted throughout Turkestan for various other atrocities.

Yakub Beg, however, was successful in driving out the Chinese; but the Khan in the mean time had his own difficulties in Kokhan, and could exercise but little control over the Kashgar expedition. Yakub Beg (Atalik) was consequently very much his own master, and when he finally heard of the Khan's death in action with the Russian troops, he decided to make himself independent of Kokhan; in consequence of this there is great enmity between him and the present ruler of Kokhan.

The Mirza found the Atalik courteous: he appeared to have simple manners, but he has the credit among his people of being very suspicious, and is known to have his spies all over the country. He has a violent temper, and his ordinary expression is a threatening one, insomuch that the people who meet him do not care to look him in the face; nearly every one looks down as he passes. When anything angers him he becomes exceedingly abusive, and is apt to take summary justice: the Mirza on one occasion saw him try to cut a petitioner down, the man only escaping by getting between some guns.

He and his son are always armed; he takes great precautions to prevent his officers holding general meetings, and he is more especially afraid of being murdered by some of the Kipchak-Kirghiz —a strong horde who opposed his rise to power. Very little talking goes on in his durbar, the conversation being chiefly confined to answering his questions, the officials all looking down as if they were afraid to look about them, and generally there appeared to the Mirza to be very much less freedom than is usual in a Central Asian durbar. He is noted for his generosity, dividing the horses, clothes, &c., which he receives as taxes, amongst his adherents; he gives a meal to some three or four thousand people every morning after prayers. The people respect him for being religious, and for what he has done in the way of making roads, bridges, schools, caravanserais, mosques, &c. He encourages the wealthier people to follow his example. He has collected a number of women in his harem, a large proportion being the wives and daughters of the Chinese whom he turned out of the country. He is said not to spend much of his time among these women.

According to the Mirza, the greatest defect of his government is in the revenue system for the collection of taxes, &c., his territory being divided out amongst his relations or friends. These officials are allowed to take whatever they like, no accounts are kept, and as long as the Atalik is paid his dues he takes no notice. The consequence is, a large amount of discontent, which is said to be shown by the greatly increased number who make the pilgrimage to Mecca, hoping that they may be less oppressed when they return as Hajis, that title generally being a safeguard against anything of the kind. Some, however, are said not to return at all, but to emigrate for good to Constantinople, &c. The taxes are paid in produce—officials having to make a yearly present in addition of large silver pieces, called yamu (160 Rupees) each, and of horses, chogas, &c., according to their rank.

On the whole, the Mirza thinks neither the people nor his officials like him; the latter secretly hate him for his harshness, and more especially for the irregular way in which they are paid. One of his rules against his own countrymen returning to Kokhan is particularly disliked. He is said to be a good soldier, exceedingly vigilant as to every movement either in his own territory or beyond his frontiers.

His army is said to consist of about 20,000 men, with 70 guns of various calibres, mostly small. In emergency it is supposed that he could muster 20,000 men more from among those Kirghiz hordes with whom he is on good terms. The soldiers consist of Sirbazi,

Tafarchi, and Sowars. The Sirbazis are armed with a matchlock and bayonet; uniform of quilted red Russian cloth, with long boots, supplied by the Government twice a year. They are drilled every morning by Affghans and Hindustanis, after the English fashion. The Tafarchis number about 2000; they are armed with very long matchlocks, taking three or four men to work them; they are mostly Chinese, who became Mahomedans when the Chinese Government came to an end. The Sowars form a very irregular cavalry. There were about 7000 soldiers in and about Kashgar itself. The guns are all brass, mostly cast by Nogai Turks, who consider themselves subjects of Russia. Some have been cast by men from Turkey (Rum), and others by Hindustanis—those by the two latter being considered the best. The guns are said to work well up to about 1500 yards. Spite of all this show the Mirza does not think the troops are at all reliable, the people generally not having much taste for fighting, and no doubt the Atalik relies mostly on his own Kokhanis.

Owing to the restraint that was put upon him, the Mirza was unable to visit the Russian frontier himself, but he made friends with a Lohani merchant who had lately arrived from Tashkend by the Naryn Valley. This man visited him very often and gave him information as to the Russian posts, and the following route, viz., from Kashgar to Kūrbāshi, 3 days' march, thence to Chādur 3 days, and to Zertash one day, all through country infested by wandering Kirghiz subject to Kashgar. From Zertash to Togia, a Russian fort, two days' march; Togia is said to be garrisoned by 400 Sappers. After two marches more the route crosses the Naryn River, over which the Russians have built a bridge, protected by a fort with 500 men. From the Naryn, at a distance of ten days' march, is Tākmāk, garrisoned by 100 men and four mountain guns, thence ten days' march farther on Allay, garrisoned by 2000 men and eight guns. The Russian garrisons increasing rapidly in proportion to the distance from Kashgar, the Lohani probably wishing to impress the Mirza with the wonders he had seen.

The Mirza's long detention and want of funds made his men mutinous again, and he was puzzled to know what to do. He first of all asked to be allowed to return by Badukshan, but the Jemadar opposed this, and said the Mirza might return with the two English gentlemen then in Kashgar, and ended by preventing him from doing either the one or the other. The Mirza had hoped that he might get some assistance from these gentlemen, and perhaps be able to assist them; but he had great difficulty in communicating with them, and the Jemadar so constantly misrepresented his

actions, that he was forced to give up the idea. He was much dispirited when these gentlemen left. Funds were his great difficulty; but he was at last relieved by meeting an Afghan prisoner who had been in the Kashmir Maharaja's service, and who was anxious to send money to his home. He offered to lend the Mirza money on the condition that it was repaid to his family in Kashmir. Having taken a small loan from this man, the Mirza was eager to be off; and finding that the Jemadar would in no way assist him, he at last in despair said he would appeal to the Atalik in person. This alarmed the Jemadar so much that he at once went and asked leave for the Mirza to return to his country. The Atalik sent for the Mirza and received him graciously, ordering him to be given a dress of honour, and gold dust worth 60 Rupees, in order to buy a horse for himself. Permission to return by the Yarkund route to Ladak was given, with a passport describing him as a Kabuli traveller. This passport bears the Atalik's seal, and the Mirza holds it as a proof that he assumed no official character while in Kashgar territory, as at one time supposed.

The city of Kashgar is built in an angle between two branches of the Kazūl River, which join one another a few miles east of the city. The Kazūl, or Kazūl Yaman, comes from Mosh (a ruined place towards the Tarik Mountains), its other branch, the northern one, is called the Toman. The united stream flows eastward, passing at 40 miles a small town called Faizabad, and after receiving the Aksoo stream joins the Yarkund River. During the winter both branches of the stream are frozen, and the Kashgar people can cross anywhere on the ice; in the summer they cross by two bridges lately built or rebuilt by the Atalik, so as to be fit for carts; these carts are drawn by two ponies or mules, and sometimes by three, arranged unicorn fashion. The city is built on an easy slope; it is surrounded by a high wall with towers at about every fifty yards; the wall is a thick one made of sun-dried bricks, and has three gateways with large wooden doors protected by iron plates. The streets are very irregular, the houses are built with sun-dried bricks and flat roofs, and touch one another. Every house has its own fireplace and chimney, where the cooking is carried on inside: the houses are generally kept very neat. The poorest houses have felts and carpets for the floors; in the better houses benches and beds are used. The bazaars are large and wide enough to allow the carts to pass one another; the shops are well stocked with native and foreign goods. The city is well supplied with water, both by canals from the rivers and from springs. There are no buildings worthy of note, the mosques and schools

(madrussa) being only a little higher, and differing in no other way from ordinary houses except in having painted doors. There are eight colleges, eleven caravanserais, and a mosque in every street, where the people are forced to say their prayers five times a day. The streets of the chief bazaars are covered in with rough timber and mats, to keep off the sun in summer, and the snow in winter.

The number of families in the city were reckoned at 16,000 in the time of the Chinese, but since their time the numbers have fallen off very much, many people having emigrated. The population is very mixed, the men comprising Turks, Tājuks, Tungānis, Badukshānis, Andijānis, Afghans, Kashmiris, Hindustanis, and a mixed race descended from foreigners and the women of the country. Tartar features and complexion predominate. The people generally are a profligate set, and, though good humoured, are crafty and inhospitable. They are generally opium eaters, and are much given to dancing or singing, though the Atalik has forbidden everything of the kind. The only musical instrument in use is a sort of harp, like the Hindustani sitara. Both sexes wear the same shaped chogas, long loose quilted cloaks of coarse cotton cloth over a tight-fitting jacket buttoned at the side; trowsers of long cloth and various coloured silk, and a cap lined with inverted lambskin, with a turned-up border completes the costume in winter. The border of the cap is sometimes made of "sugbao" or "sugābi" (otter) skin from Kashmir or Hindustan, but the skins from Russia are preferred. The crown of the men's caps is generally made of plain Russian broadcloth: the crown of the women's caps is generally of Benares brocade (kinkab), cloth embroidered with gold thread. In the summer these caps, lined with lambskin, are changed for others made of cotton cloth fitting to the head, the caps well starched so as to preserve their shape. Those worn by the women are of a different shape, the women of the richer classes using Benares brocade, or a cloth embroidered with twisted silver thread got from Russia. Both sexes wear long high-heeled boots, those worn by the women being shod with iron, those of the men having no iron; the leather is generally native, made from goat-skins dyed red, or pink; the richer people occasionally using Russia leather. The boots of the women look very gay, being ornamented with red or yellow silk, &c. The women do not wear many ornaments, beyond a few rings, and three or four heavy silver or gold buttons of an almond shape worn in the body of their dresses. They are fond of flowers, and wear them in their caps: a few flowers are grown in the court-yards of each house. They do not darken their eyelids with antimony, but instead paint a dark line

so as to join the two eyebrows. They wear two long plaits of false hair which hang down their backs. They are not seen much in public, as whenever they go out they are obliged to wear a large black or white "burkha," a sort of sack, which covers them from head to foot, a piece of muslin with eye-holes being used as a cover for the face. This is a new custom in Kashgar, introduced by the order of the Atalik, which the women particularly dislike.

Level ground extends to about 40 miles south of Kashgar, 30 miles to the west and 15 miles to the north, while to the east there are very extensive plains. To the west and northwest there are high mountains connected with the Pamir, which enclose the Alai Tarik and Naryn valleys: they appear to be distant.

Kashgar is said to be very healthy; in winter the climate is dry, and so cold that fires are required in every house: rivers, tanks, and canals all freeze, and water is only got from the four springs, which seldom freeze hard. Snow falls very often, but seldom to a greater depth than a foot; it moreover soon melts: the river remains frozen till the end of March, and no snow is seen after that till December or January. In the spring the weather is very stormy, and the wind so strong sometimes as to blow down the Khirghiz tents that are pitched in the neighbourhood. The stormy winds are invariably accompanied by a hazy atmosphere, sometimes to such an extent that lights are required in the middle of the day. This is supposed to arise from an impalpable dust. The Mirza says that during the four months he was in Kashgar, he could never see the sun clearly until some hours after it had risen; it was always more or less obscured by a sort of dust or haze, and only three or four times really clear: The sun always had a sort of pale red colour for three or four hours after it rose.

At length, after a detention of more than four months, the Mirza was allowed to start for Yarkund on the 7th of June, 1869.

He crossed the Karakoram Pass in safety and reached Leh, the capital of Ladak, during August; thence he made his way to Kashmir and back through the Punjab to the Head-quarters of the G. T. Survey, having been absent on his expedition nearly two years.

The Report will be published entire, with Major Montgomerie's Memoranda and map, in the 'Journal,' vol. xli.

The CHAIRMAN said that the great interest which was taken in the country over which the Mirza had travelled was due to the fact that it was intermediate between the Russian territories and our Indian possessions. Sir Roderick Murchison had often impressed on the Society his conviction that although the question of the Russian approach to India was of great interest,

it was one which we might look steadily in the face without any sense of danger, and he (the Chairman) coincided with Sir Roderick in this view. He thought, in fact, that the nearer England and Russia approached each other in Central Asia, the more advantageous it would be in some respects for both nations, inasmuch as it would remove impediments to free communication, promote trade, and put an end to the anarchy and disorder which were at present rampant throughout the country. It was not generally known that Russian and English explorations had now actually approached within 20 miles of each other; yet such was the case. Baron Osten-Sacken's expedition had penetrated from the north, as low down as Artush, while Hayward and the Mirza, proceeding from the south, had taken observations as high up as Kashghar, the distance between these points being something under 20 miles. Indeed the gorge in the hills which had been reached by the Russian expedition could be seen from the town of Kashghar, and, as far as scientific results were concerned, the two lines of survey might be considered therefore to have coalesced.

He would now refer to the Mirza's journey somewhat more in detail. The most interesting portion of his line of route was that which followed the valley of the Upper Oxus, from the junctions of the two arms of the river at the fort of Penja to the source of the left branch in the Pamir Lake; he then crossed over the watershed to Tash-Kurghan, and from that town pursued an entirely new track to Yengi Hissar, and so on to Kashghar. The route along the Oxus was not absolutely new to geography, although Major Montgomerie seemed to consider it so; as he would now undertake to show. As far as the fort of Penja, Lieutenant Wood and the Mirza had followed the same track; but at that point the routes divided,—Wood having traced up the right arm of the river, and the Mirza the left. Marco Polo, however, more than six centuries ago, had probably taken precisely the same route as the Mirza, in passing from the Oxus across the Pamir plateau to Kashghar, and a still more detailed account of the line was to be found in the Tarikh-i-Rashídí, where Mirza Hyder, a cousin of the Emperor Baber, described his march from the Karakoram Pass by *Raskam* and *Tágh dum básh* to Pamir and Vakhán. This Persian history further contained much valuable information about the mountains and rivers of Kashghar amd Yarkund, which agreed in all essential points with the Mirza's discoveries. The next authority in point of time was the Register of the Jesuits, who in the middle of the last century had, under the Chinese Government, pushed their researches as far as Sarik-kul, on the extreme western frontier of the empire: the observation which they took for latitude at this point agreeing within 3 miles with the position assigned by the Mirza to the town of Tash-Kurghan, which is the capital of the district. After the Jesuits came Macartney, who, in 1808, at Peshawur, must have received from Indian traders an itinerary of the whole line from *Sirhad Vakhán* (where the Chitral route debouches on the Oxus) to Yarkund, as the stages named by the Mirza and others are given in the Map to Elphinstone's 'Cabul' with perfect regularity; though, as Macartney's informants were unable to supply bearings, he has laid down the itinerary from south to north instead of from west to east. Of late years, again, there has been a native traveller, Mahomed Amin, who must have frequently crossed the Pamir from the Upper Oxus Valley to Yarkund and Kashghar. Mr. Davies's 'Report on the North-West Boundary' contains a series of routes supplied by this traveller across the Pamir; and one of these routes must have been the exact line followed up by the Mirza, though strangely enough the particular lake of Pamir-kul or Berket-i-Yassin is not named in Mahomed Amin's itinerary. This last named traveller was not, it is true, a scientific explorer: he was unable to use instruments or take observations; but his general descriptions were interesting and accurate and for a long time supplied our only reliable information regarding the Upper

valley of the Oxus. Mr. Hayward it was expected would have resolved all difficulties regarding the hydrography of the Pamir plateau, but he had been murdered (as Sir Henry reminded the meeting) at the threshold of his discoveries; and although another native explorer of the name of Ibrahim Khan had been sent by Mr. Forsyth from Cashmere, in anticipation of Mr. Hayward's visit, and had actually made the detour by Gilgit, Yassin, and the Darkút Pass to the valley of the Oxus, which was contemplated by the English traveller, rejoining the head-quarters of the Mission at Yarkund, the details of his journey, which would form an important link in uniting the Surveys of Mr. Hayward and the Mirza, had not yet been received in England.

It was thus shown that the line of country along the Upper Oxus was not absolutely unknown, as Major Montgomerie seemed to think; but, at the same time, he (Sir Henry) admitted that the Mirza's journey was by far the most important that had been undertaken along that particular track, being in fact the only journey which supplied materials at all fitted to the scientific requirements of the age. The most important result of the journey was the determination of a great feature of Physical Geography, which was entirely opposed to Humboldt's theories, but which Major Montgomerie now recognized as an undoubted fact. This was the discovery that the Pamir highlands were not, as had been supposed, a transverse range joining the Himalaya with the Thian Shan Mountains to the north, but were, in fact, a prolongation of the axis of the Himalaya. The watershed between the Indus and the rivers of Turkistan was found to commence at Kailás, near the sacred lake of Manasarowar, and to run from that point in a north-westerly direction to the Kara-koram and Muztagh passes, continuing on almost in a straight line along the crest of the Pamir Plateau, where the Oxus, however, instead of the Indus, took off the western drainage, until it finally received the water-system of the Jaxartes. The paragraph in which Major Montgomerie announced this important discovery in Physical Geography was well worthy of being quoted. He says:—

"The Mirza's route gives us another determination of the great watershed which separates Eastern Turkistan from the basins of the Indus and the Oxus, viz., the Pāmīr-kul Lake, which comes between the Mustagh Pass (the most westerly point actually on the watershed determined by my survey operations) and the Sirikul Lake of Wood; and this new determination confirms the opinion that I have held for many years, that the said watershed continues to run north-west from the Mustagh,—a conclusion which I came to from the positions of many gigantic peaks fixed by the survey to the north-west of the Mustagh, which peaks, though probably not on the watershed, doubtless indicate its general direction. From the Changchenmo east of Leh to the Mustagh the general line of the watershed is about 35° north of west, from the Mustagh to Wood's Sirikul it is about 38° north of west, and the same line would run nearly through the Pāmīr-kul. Further to the north I am not inclined to think that the general direction of the watershed alters very rapidly."

Sir Henry went on to say that although the precise line of the watershed had not been traced across the Pamir plateau, he was satisfied that Major Montgomerie was right in assuming it to follow the same general direction of about W. 40° N., until it met the Alai Mountains, forming the southern boundary of the Jaxartes Valley. Another rectification of Physical Geography which was due to Major Montgomerie's researches referred to the general law affecting the lines of watershed. Explorers, he showed, who merely took the angles of high peaks from a distance and fixed the watershed of the range accordingly, were almost always in error, because the culminating peaks were usually on transverse ridges, far in advance of the line of drainage; the rivers flowing down the ravines from the great range in rear, and passing at the side of the peaks which were supposed to be on the watershed.

The hydrography of the Pamir was still involved in much obscurity.

Lieutenant Wood had discovered one lake upwards of 30 years ago, and the Mirza had now discovered another lake somewhat more to the south; but neither of these explorers could be said to have discovered the real source of the Oxus. The name of *Penj*, which was given to the Upper Oxus, showed that the river was formed of five distinct branches, as the Oriental geographers always admitted, and Mahomed Amin had further named and described the five lakes from which these five branches flowed; the most distant and most extensive of these lakes being the famous Karakul, or "Dragon Lake" of the Chinese, which had, accordingly, the best claim to be regarded as the true source of the river. It was quite certain now that the name of Sirikul, which Lieutenant Wood had applied to the lake discovered by him in 1838, was a spurious title. The defile which Lieutenant Wood followed up from the junction of the two arms of the river at Hissar, was, no doubt, called the *Dereh-i-Sirikul*; but that name was given it, not from the lake by which the road passed, but because the road led to the district of Sirikul, just beyond the watershed. The true name of this district, the capital of which was Tash-Kurghan, was Sárik-kul (or the Yellow Lake), as it appeared in all the Oriental authorities, being so-called probably from a lake in the vicinity of Tash-kurghan which had since disappeared. Tash-Kurghan itself was a very remarkable place, and Major Montgomerie had particularly drawn attention to the Mirza's description of it, a description which closely tallied with Mahomed Amin's published account. He (Sir Henry) was disposed to identify it with the famous "Stone Tower" of Ptolemy, where the trading caravans rendezvoused before crossing the great desert to China. The literal meaning of Tash-Kurghan was the "Stone Fort," or "Stone Tower," and there could be no doubt, from the character of the masonry of which the works were composed (large blocks of hewn stone), that the fort was very ancient, and of great importance in early times. On many old maps this town was called *Karshu*, which means a "Palace," or "large building;" but he had never found such a title applied to a place in the district of *Sárik-kul* in any Oriental author, nor could he trace it earlier than the time of Petit de la Croix. It was certainly quite unknown in the country at the present day, and ought to be expunged from the map of Central Asia. The Mirza's description of the rivers of Kashghar and Yarkund was very valuable, because it nearly coincided with the statements left on record by Mirza Hyder in the Tarikh-i-Rashidi, and in that respect seemed to be more accurate than the statements of our recent English travellers. Sir Henry explained the discrepancy between Mr. Hayward's account of the hydrography of Kashghar and the Mirza's, by observing that it was very difficult to distinguish between the rivers and the canals, inasmuch as the latter contained far more water at the present day than the former, and were thus very liable to be mistaken for them. The Mirza, however, did very accurately discriminate between the canals which were narrow, but full of water, and the old river-beds which were nearly dry, but which measured 150 yards across; and his definitions, which did, no doubt, indicate the true hydrographical features of the region, were more in consonance with the relative position of Mirza Hyder's rivers than were Mr. Hayward's names and distances.

The only other point requiring notice referred to the longitudinal position of Yarkund. Nothing had been hitherto more confused and unsatisfactory than the longitudes of places in Eastern Turkistan. There was, indeed, a variation of no less than 4° in the position assigned to Yarkund; and as this point ruled all the other longitudes, the maps were contradictory, and really possessed no authority. The Schlagintweits, who professed to connect their line of projection with the Trigonometrical Survey of India, placed Yarkund in 73° 30′, while Major Montgomerie, having compared the Mirza's results with the work of all previous travellers, decided that the true latitude of the

Southern Capital of Turkistan was 77° 30′, and constructed his map accordingly. This result we had been quite prepared at the Geographical Society to accept as certain and determinate, having full confidence in Major Montgomerie's careful analysis, of which a very interesting account was given in his preliminary Report; but at the last moment we had found it stated in Mr. Forsyth's Report of his Mission to the *Ataligh Ghazi* that Mr. Shaw, who had used instruments throughout the journey, had ascertained the longitude of Yarkund to be only 76°. Now as this discrepancy of 1½° between Major Montgomerie and Mr. Shaw threatened again to throw the map into confusion, they had thought it as well, in anticipation of this evening's meeting, to send the register of Mr. Shaw's lunar observations at Yarkund to Greenwich to be worked out, so as to set at rest for ever this disputed question of longitude. The Greenwich Report had been now returned, giving from a series of lunar observations a mean result of 77° 15′ for the longitude of Yarkund, so that Major Montgomerie's calculation from the Mirza's data was shown to be nearly correct, and Mr. Shaw's reported determination of a longitude of 76° to be a mistake.

In conclusion, Sir Henry said that, in bearing testimony to the Mirza's services, we were really expressing our obligations to Major Montgomerie himself, as it was to him we were indebted, not only for this particular journey, but for the introduction of the system of educating natives of India for geographical exploration,—a system which had already led to such important results, and to which we must wish every success in future.

Sir ANDREW WAUGH said, it would be universally admitted that this exploration makes a very useful addition to our geographical knowledge of the hitherto unknown region, between Badakshan and Eastern Turkistan. We are much indebted to Major Montgomerie, our Gold Medallist, for this as well as his former explorations, which have rendered our knowledge of this part of Central Asia accurate and precise for practical purposes. The great uncertainty that formerly prevailed in the position of most important places in Central Asia was shown in a table by Major Montgomerie. The Schlagintweits placed Kasbgar some 250 miles too far west, and Yarkund 200 miles, to the great despair of our geographers, who could not reconcile these enormous discrepancies. Humboldt's discussion of the Jesuits' work, was also inaccurate in result. It had remained for Major Montgomerie to produce order amongst all this chaos.

The reason why the Major's operations had turned out so well, was, that they have been conducted on systematic principles, instead of being desultory, partial, and incomplete. His surveys have always started from a known point of departure, and closed on a known point, so that the error generated between has been ascertained. The routes have, further, been tested as often as practicable, by astronomical observations and by combination with other routes. Great skill has been shown in ascertaining the probable value of the itinerary measurements, according to the character of the ground. In his printed reports, the Major has discussed the Mirza's routes in a very masterly manner; analyzing carefully their relative and general values. All the credit of originating and systematizing these interesting and most difficult explorations was due to Major Montgomerie; and he (Sir Andrew) must admit that his agents have succeeded, in a most marvellous manner, in carrying out a work beset with formidable difficulties. He recollected warning the Schlagintweits that, if they were not careful, they would get all abroad in their longitudes; and sure enough, after going a few hundred miles, they got 3 degrees out, as shown in Major Montgomerie's Table. They considered it quite an easy matter, and took no precautions in consequence. Hence all these errors and confusions were of a preventible character, and not at all inherent in the nature of mountain operations, if systematically conducted.

The Mirza's results had been tested very often by comparison with other routes, and always met that test well. It was a difficult matter to explore such regions. It was like surveying over the tops of the Alps, without the advantage of such comfortable places as Interlaken and Chamouni below to take refuge in. The poor Mirza must have had a very hard time of it, crossing the Pamir range in midwinter; but rigorous as the climate was, it would have been worse for him to have attempted it in summer, as then he would have been most likely robbed and murdered. The rivers in summer would have been full of water and difficult to cross. The Mirza is entitled to great praise for the enterprise, pluck and endurance he exhibited, as well as for the professional skill he displayed. He deserved full credit for the excellence of the results.

Colonel WALKER said he thought Mr. Shaw was quite right in saying that the Karakorum range was no range at all. At certain points its watershed is very low, and very easily crossed. He believed that a counterpart to this would be found in what is called the Hindoo Koosh range, and he felt assured that there is no well-defined range where the Hindoo Koosh is represented to be. He had recently sent an officer—Capt. Carter—up to the Peshawur frontier for the purpose of ascertaining whether that lofty watershed really existed. The British frontier does not extend very far into the hills, and the peaks have ranges immediately to the north of them which cut out all view of the very distant ranges; but to the south of the Peshawur Valley, in the Kuttuk Hills, there are points from which a person can see across the Peshawur Valley in the direction of the so-called Hindoo Koosh range. Captain Carter remained on those points for several weeks, watching for opportunities of catching the peaks of the Hindoo Koosh range. He fixed about one hundred peaks in all, but none of them fell on a continuous range. He therefore believed that the watershed was occasionally very low, and that there was really no continuous range at all. What had been said about the facility of crossing from the Oxus into the valley of the Chitral River corroborated this view. It was quite impossible to employ European surveyors to explore these countries, though one —Mr. Johnson—had successfully gone to Ilchi and come back, to the astonishment of everybody, with his head upon his shoulders. The difficulties were so great that even the Pundits of the survey could only go into a Buddhist country, while for Mahommedan countries it was necessary to employ Mahommedans, generally Pathans. The Trigonometrical Survey had experienced great difficulties in training their agents, and met with many disappointments. Out of six or eight men that they had spent years in training, only two or three had turned out to be first-class men. The very first man sent out died under very suspicious circumstances on his return to Leh. The next man they sent out was a Pathan of the Native Sappers and Miners—a very intelligent man indeed, and one who promised exceedingly well. He had been trained for a year, and was sent off into the country immediately to the north of Peshawur, to explore up towards Chitral and the regions on the borders of the Indus, of which less is known than of districts further away. It happened, unfortunately, that this man, being a Pathan, had a blood feud in his family, and no sooner had he got out of British territory than the avenger of blood went after him and murdered him. He had been travelling six weeks, and obtained a little information; and when the officers of the Survey heard of his death, they were very much afraid that it was caused by the people of the country, but afterwards it was ascertained that he had been very well treated by the people. His papers were all collected and sent back by no less a person than the Akhoond of Swat, who was supposed to be one of the most bitter foes of the British Government. The next explorer was also a Pathan. For mountain regions inhabited by a treacherous Mohammedan population, men of great physique, great courage and considerable intelligence, are required;

and Pathans, as a rule, have lots of pluck and nerve, but ninety-nine out of a hundred do not know how to read and write. It is, therefore, particularly difficult to make a beginning with them. This man was taken from the Quarter-Master-General's department, and was being trained by one of the Pundits, who had a watch which had been presented to him by the Royal Geographical Society. Unfortunately, the Pathan coveted that watch, and instead of waiting and trying to get a watch from the Society by his own honest, straightforward exertions, he thought the simplest plan would be to appropriate the Pundit's watch,—which he succeeded in doing, but so very cleverly that the theft could not be legally proved against him, though there was no doubt that he was the thief. The last thing heard of him was, that he had attached himself to the unfortunate Mr. Hayward; and it was believed that he was murdered with Mr. Hayward; but if not, it is not improbable that he had a hand in the murder of that gentleman. The officers of the Survey are careful not to teach these men too much, simply the practical details of what they have to do, because implicit trust could not be placed in their honesty and veracity. They are taught to observe, but not to reduce their observations, which is invariably done by their officers after their return to head-quarters. They were marvellously accurate observers, and would go out of an evening and sit patiently and watch the stars as they culminate one after the other, and wait for hours getting all the data necessary for the accurate determination of the latitude; but without the faintest notion of how to deduce the result—which the officers take very good care not to teach them. Unfortunately, by their observations only one of the two co-ordinates of position are obtained; the other—the longitude—is very difficult to determine, and is far beyond what can be expected of the native explorers: to obtain this, men of far higher intelligence and better education would be required, and they would probably be too clever to be trusted. On their journeys the explorers take bearings in the direction that they are going, and measure the distances in paces. They carry with them beads, and in a Buddhist country they tell their beads just as a rosary might be used in a Roman Catholic country. At every 100 paces they drop a small bead; at every 1000 paces a larger one; and so a strict reckoning is taken of the distances they walk, and every now and then they take the bearings of the line of route. The observations have to be made without attracting attention; for if the men were seen constantly making notes on paper, suspicion would be aroused. In the exploration of Thibet it was found convenient to give the explorer a prayer-wheel, into which he inserted his compass and the memoranda of the day's distances and bearings, and he would go about twirling this round and round, after the manner of the religious people of the country, and thus preserve a character for respectability. The traverses are eventually computed out by the method of rectangular co-ordinates, parallel and perpendicular to a given meridian. The differences of the distances on the meridian are checked by the corresponding differences of the astronomical latitudes, which serves to show whether any accidental gross error has been committed, and to furnish a correction for the value of the length of the pace,—the unit of measure which is used in the calculation of the traverse. The value of the pace of course differs in different countries: in a very hilly country a man's pace would be short; over smooth and level country he would step further. The corrected value of the pace is applied to determine the difference of longitude on the perpendicular. This is a rough and ready way of reducing the work; but, considering the class of men employed, it is the best—in fact, the only one—that could possibly be attempted.

Eleventh Meeting, 8th May, 1871.

MAJOR-GENERAL SIR HENRY C. RAWLINSON, K.C.B., VICE-PRESIDENT, in the Chair.

ELECTIONS.—*Capt. George G. Beazeley*, 83rd Regiment; *John Bourne, Esq.*, C.E.; *John Bowes, Esq.*; *Dorabjee Pestonjee Cama, Esq.*; *Edward Harris, Esq.*; *George Thomas Hertslet, Esq.*; *Thomas Hughan, Esq.*; *Rev. Vyvyan Henry Moyle*, M.A.; *Eustratius Ralli, Esq.*; *George Samuel Fereday Smith, Esq.*, J.P. &c.; *Captain James B. Walker*; *Rev. S. T. Whitnee.*

ACCESSIONS TO THE LIBRARY FROM APRIL 24TH TO MAY 8TH.—'On the Physics of Arctic Ice, as Explanatory of the Glacial Remains in Scotland.' By Robert Brown, of Campster. Edinburgh, 1871. Donor the author. 'Some Little-known Oaks from North-West America.' By Robert Brown, of Campster. Edinburgh, 1871. Donor the author. 'Notes on the Natural History of the Strait of Magellan and West Coast of Patagonia.' By Robert O. Cunningham, H.M.S. *Nassau*. Edinburgh, 1871. Purchased. 'Journal of a Voyage up the Irawaddy to Mandalay and Bhamo.' By J. T. Wheeler. Rangoon, 1871. Purchased. 'Classical and Pre-Historical Influences upon British History.' By Saxe Bannister. 2nd edition, 1871. Donor the author. 'Die Geologischen Verhaltnisse des Oestlichen Theils der Europäischen Turkei.' Von Prof. Dr. F. v. Hochstetter. Wien, 1870. Donor the author. 'Land Journey from Canton to St. Petersburg, through the Plains of Mongolia and Siberia.' By W. Anthony White. 1871. Donor the author.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING OF APRIL 24TH.—Six sheets of the Geological Survey of Sweden. Presented by the Geological Society of Sweden. MS. Map of the Geysers in Iceland. By Lieut. J. C. Ardagh, R.E. Presented by the author. East Coast of Greenland, showing the track of the German Expedition in 1869-70. Presented by Dr. Petermann. East Coast of Spitzbergen, showing the track of the Heuglin-Zeil Expedition, 1870. Map of the New Boundary between France and Germany, settled February 26th, 1871. Presented by Dr. Petermann. MS. Map of a Route from Pekin to Kalgan, and to the Northward of Pekin. By G. Goodall, Esq., F.R.G.S. Maps of the Survey of India, consisting of 22 maps on 50 sheets. Presented by Her Majesty's Secretary of State for India.

The following communications were read:—

1. *Letters from Dr. Kirk, concerning Dr. Livingstone.*

(Communicated by the FOREIGN OFFICE, through LORD ENFIELD.)

"MY LORD, "Zanzibar, March 10, 1871.

"I have the honour to forward, in translation, copies of letters just received from Ujiji, from which it will be seen that up to five months ago Dr. Livingstone was at a place named Manakoso, and only awaiting the men and supplies sent off by me last year, and that they have now reached him, or at least been forwarded from Ujiji to the place where he is.

"It being now time to close letters, for transmission by the present occasion, I shall not be able to make inquiry among the Arabs acquainted with these parts as to the position of the places named, but which I suppose are on the western side of the lake.

"JOHN KIRK."

(TRANSLATION.)

To Consul Kirk, from Sherif Basheikh bin Ahmed.

I have to inform you that on the 15th of Shaban (10th November), a messenger came from the people of Menama with letters from the Arabs who are there, and one from the Doctor, and these letters were dated the 20th Rejib (15th October).

In answer to my inquiries, they told me that the Doctor was well, although he had been suffering; and that he is for the present at the town of Manakoso, with Mohamed bin Gharib, waiting for the caravans, being helpless, without means and with few followers, only eight men, so that he cannot move elsewhere or come down.

We have sent off twelve of our men with American cloth, kaniki, beads, sugar, coffee, salt, two pair of shoes, shot, powder, and soap, and a small bottle of medicine (quinine).

All that he was in need of we have sent to him, and I remain at Ujiji awaiting his orders.

Dated 20th Shaban, 1287 (15th Nov., 1870).

True translation. JOHN KIRK.

(TRANSLATION.)

To Ludda Damji, from Said bin Majid.

(*After compliments*).—This letter is from Ujiji, and the news here is good, and nothing but good to report. Trade also is prosperous.

Letters have come from the people of Menama, from Mohamed bin Gharib and his people, and they have got good prices, such as please them; and the Christian is in their company, and they intend returning to Ujiji in the month of Safr (April, 1871).

Sherif reached Ujiji, having with him the goods of the Christian; and we intend sending some of these goods to him, for he is destitute, and the people of Sherif will accompany the messengers who take the letters.

"MY LORD, "Zanzibar, 18th Feb., 1871.

"I have the honour to report that information having reached me, through a native, that the men sent off by Mr. Churchill with stores for Dr. Livingstone, as reported in his Despatch of the 18th Nov., 1870, were still at Bagamoyo, a coast-town on the opposite mainland, and had not taken any steps to procure porters and proceed on their journey, I determined, if possible, to go myself and see them off. Captain Tucker, commanding

H.M.S. *Columbine*, on my request, kindly offered to place his ship at my disposal for this purpose.

"On reaching Bagamoyo, I found that the men referred to were still living in the village, while Arab caravans set out on the same journey. It is true that porters this year are difficult to obtain, few of the people of Unyamwezi having come down, in consequence of deaths last year from cholera among their friends.

"However, by using my influence with the Arabs, I succeeded at once in sending off all but four loads, and followed inland one day's journey myself. The remaining four loads I arranged on my return were to be taken as far as Unyanyembe by an Arab caravan, and thence sent to Ujiji by Said bin Salim, the governor.

"Once fairly off on the road, there is little to induce these people to delay; whereas at Bagamoyo, living in good huts among their own people, and thinking that there, unknown, they might enjoy themselves and earn monthly pay, had I not gone in person they might have loitered yet several months.

"While passing along the trade-route on the short excursion I made from Bagamoyo, we met several caravans on their way from Unyamwezi, Urori, &c.; and by questioning the natives, as well as the leaders, found that no news had been received lately at Unyanyembe from Ujiji, and nothing known of Dr. Livingstone. All were aware that he had gone on a journey, from which he had not yet returned up to the latest dates.

"The country I passed through after crossing the River Kingani was like a beautiful park and woodland, full of all sorts of big game, including the giraffe, eland, zebra, hartebeeste, wilde-beeste, &c., some of which I shot not more than 12 miles from the coast-town of Bagamoyo. The Kingani River was full of hippopotami, and on its banks wild buffaloes were found.

"Unfortunately wherever the giraffe exists in numbers this rich and comparatively healthy region is infested by the 'Tsetse' fly, so dangerous to cattle and horses.

"On my return to Bagamoyo, I devoted a day to the study of the French mission establishment, and their management of freed slaves. On this I shall do myself the honour to submit a separate report to your Lordship.

"Since my visit, four years ago, I found the town of Bagamoyo to have trebled its extent. Native huts were fast being replaced by stone buildings; and here, as elsewhere on the coast, the trade rapidly passing into the hands of the Kutchees.

"JOHN KIRK."

The CHAIRMAN, in commenting upon the above letters, said that Sir Roderick had begged him to state to the meeting how gratified he was, before retiring from the office of President, to receive a confirmation of the safety, to so late a date, of Dr. Livingstone, in whom he had always taken so profound an interest. The meeting would remember that, through good report and evil report, Sir Roderick Murchison had stood to his colours manfully; and, almost alone among the geographers of England, he had lent a deaf ear throughout to all possible insinuations or fears regarding Livingstone's safety. Sir Roderick's gratification was, however, tempered with pain at not being able to be present on this occasion, when the intelligence was to be communicated to the Society.

The most important letter now communicated was that from the Arab officer who had been sent up by Dr. Kirk in charge of stores from Zanzibar to Ujiji. He reached Ujiji, it would appear, in last September, and on the 15th October he received a letter from Dr. Livingstone. The Sherif's letter was of considerable interest on various grounds. It stated that he had received Dr. Livingstone's letter (of October 15th) on the 10th of November, thus

showing that Dr. Livingstone at that time was only twenty-five days distant from Ujiji. It further showed that the Sherif was so much interested in the matter as to send off twelve men with the supplies immediately on the receipt of Dr. Livingstone's letters. They were all gone before the 15th November. That was very satisfactory. The second letter was from an Arab merchant, written to his correspondent at Zanzibar, and apparently quite independent of the Sherif. It was probably written a day or two before the Sherif's letter, as it stated that the stores and supplies were about to be sent, whereas in the Sherif's own letter it is stated that they had actually been sent before the 15th November. There was a remarkable expression in this second letter, to the effect that the caravan with which Livingstone remained intended returning to Ujiji from Manyema in the month of Safr, that is about the present time; so that the merchant's arrangements were to remain for five months longer at Manyema, in order, no doubt, to complete the purchases and sales, and then to come on quietly to the coast. It did not follow, however, that Dr. Livingstone would wait five months needlessly at Manyema. The intelligence and supplies sent from Ujiji on the 11th of November would reach him, at any rate, by the 15th December; and, if he wished to return at once, he might leave by the end of that month, so as to reach Ujiji about the end of January. If he continued his journey at once he might reach the coast in about three months and a half from that time, that is about the end of April. This was supposing he was determined to return to England immediately on receiving his supplies. Of course, at this distance of time and place, it was impossible for us to speculate with any confidence on what his next step might be. We knew, however, that all Livingstone's later movements had been in accordance with his preconceived plans. He had been above a year in this country of Manyema, his previous letters being written in May, 1869, from which date up to October, 1870, he had been occupied in his explorations. His own account of what he intended to do was sent to Dr. Kirk in May, 1869, when he said "As to the work to be done by me, it is only to connect the sources which I have discovered from 500 to 700 miles south of Speke and Baker's, with their Nile. The volume of water which flows north from lat. 12° s. is so large, I suspect that I have been working at the sources of the Congo as well as those of the Nile. I have to go down the eastern line of drainage to Baker's turning-point. Tanganyika, Nzige Chowambe (Baker's?) are one water, and the head of it is 300 miles south of this. The western and central lines of drainage converge into an unvisited lake west or south-west of this. The outflow of this, whether to Congo or Nile, I have to ascertain. The people west of this, called Manyema, are cannibals, if Arabs speak truly. I may have to go there first, and down Tanganyika, if I come out uneaten, and find my new squad from Zanzibar." Therefore, from May, 1869, to October, 1870, he was occupied in the very researches to which he alluded in this letter, and whether he came home at once or remained another year would entirely depend on the results he had obtained during that interval. If he had satisfied himself that the waters he had been following turned to the westward and formed the head-waters of the Congo, he (Sir Henry) thought he would most likely come home rather than follow them to the west; if, on the other hand, he found that they ran to the north, whether he would think it necessary to follow them to the Albert Nyanza or proceed to Zanzibar, would depend upon his health and other circumstances. But, from his knowledge of Livingstone's character, he believed he would rather sacrifice himself than leave the problem unsolved, especially if he heard of Sir Samuel Baker being about to launch his boats on the Albert Nyanza. He (Sir Henry) could not help thinking that if Livingstone was in tolerable health after obtaining his stores, and was able to take the field again, he would prefer completing the great work upon which he was engaged. However, that was a matter of speculation.

COLONEL GRANT said that Burton and Speke had crossed the lake from Ujiji, and heard of this country which Livingstone had visited. At the point which they reached they met a trading-party, similar to the one employed by Dr. Kirk to convey the letters and provisions to Livingstone. This proved that trade had been carried on here for many years. Even Indians from Bombay sent their messengers far away to the west and north, and at certain seasons of the year the ivory was collected: when the crops were ripe their caravans went down to the coast, arriving at Zanzibar in October and April. At any other time solitary individuals might cross, but caravans of fifty or sixty people would never attempt it. He thought that Dr. Livingstone, when he received the supplies, would wait until the traders returned to Zanzibar. However anxious he might be to get back to England, he would not be able to move until the harvest season, and he might, therefore, arrive either at the end of this year or not before next April. As yet no account had been received from Livingstone of the exact elevation above the sea of Lake Tanganyika. It was merely conjecture on Livingstone's part that its waters went northward; but he (Colonel Grant) was of opinion that the Victoria Nyanza, and the Lakes of Karagweh, which flow into it, are, and would eventually be found to be, the most elevated of all the sheets of water that supplied the Nile, and therefore its true source.

Mr. FRANCIS GALTON believed that no anxiety need be entertained about the safety of Dr. Livingstone. Our great traveller had a reluctance to giving partial details of his explorations, preferring to bring back the results of the whole: communications, therefore, might not be received from him so frequently as geographers wished. There was no ground for crediting Livingstone with any excessive home-sickness. He was as much at home in Africa as in England, and, in fact, he had spent more of his life in Africa than in England; therefore, when he received his supplies, if he had more work to do, no doubt he would remain. He warned the Society not to expect too much from Dr. Livingstone's labours during the past year, since it is more probable than not, that his freedom of movement had been much embarassed by the want of supplies. Progress in Africa very much depended upon accident. Livingstone, in his early journeys, swept across Africa with great rapidity; but during the last four or five years his journeyings had only reached from Zanzibar to Manyema. Before concluding, he took the opportunity of expressing his admiration of the recent achievements of a solitary German botanist, Dr. Schweinfurth, whose remarkable route had been laid down on the large map hung up on the wall, and who had apparently succeeded in connecting the basin of the Nile, in a latitude south of Gondokoro, with the basin of Lake Tchad.

The Rev. HORACE WALLER said he was delighted to know that the right kind of stores had been sent to Livingstone. Those who had travelled in Africa knew that the loss of shoes alone was almost equivalent to the loss of life. On two occasions Livingstone and Kirk suffered most severely from their shoe-leather wearing out; and, as Livingstone had been away much longer than he had originally expected, no doubt he had been in great want of shoes. He believed that if Livingstone had satisfied himself that the waters of Tanganyika were connected with the Albert Nyanza, and thence found their egress through the Nile, he would at once come back to England. If there was one thing he hated more than another, it was to travel with an Arab caravan, where he would be surrounded by slaves throughout the whole route; and rather than do that he would, as he had on many occasions previously, tramp it to the coast by himself.

2. *On the Landfall of Columbus.* By R. H. Major, F.S.A., Secretary to the Royal Geographical Society.

The author stated that it was well known that Columbus gave the name of San Salvador to the island which he first discovered, and that its Indian name was *Guanahani*. In 1847, when he edited for the Hakluyt Society the 'Select Letters of Christopher Columbus, illustrating his four voyages to the New World,' he fell into the error of adopting too readily the conclusions of Navarrete that the *Great Turk*, the northernmost of the Turk Islands, was the true Landfall. In 1793, Muñoz concluded the island first discovered by Columbus, and named by the great navigator San Salvador, to be the one now named Watling's Island. Navarrete, in 1825, as had just been stated, believed it to be Turk's Island; Washington Irving, in 1827, supported by Humboldt, made it Cat Island, which for nearly 200 years has erroneously borne the name of San Salvador. Such different conclusions, formed by thoughtful men from an examination of the diary of Columbus and other early documents, caused him to set a great value upon any modern reconnaissance of the locality which might throw a fuller light upon these documents and show which of the conclusions was correct. It happened that a communication, made a short time previously by Mr. Gibbs, a resident on Turk's Island, presented several points of evidence apparently confirmative of the correctness of Navarrete's deductions. The author, however, by a comparison of Columbus' diary, showed that Mr. Gibbs' statements on essential points in the identification were incorrect. He then went into a minute comparison of the great navigator's diary, with a modern chart, and proved to demonstration that Watling's Island was the Landfall. In 1856, the claims of Watling's Island found a fresh champion in Captain Becher, in his work entitled 'The Landfall of Columbus;' but in 1864 Senhor de Varnhagen, in his 'Verdadera Guanahani de Colon,' and again so late as 1869, has put in a claim for the island of Mayagnana. After proving, both by the Diary of Columbus and by a facsimile copy of a Map of the Bahamas, published in 1601, by Herrera, the historiographer of the Indies, in Spain, that this latter pretension was untenable, the author proceeded to confirm, by the latter document, the identity of Watling's Island with Guanahani. But while thus proving the correctness of Muñoz and Captain Becher on this head, the author entirely disagreed with the latter as to the point of anchorage, and also as to Columbus's movements while at Watling's Island. Not one of Captain Becher's statements or conclusions on this subject is in accordance with the Diary, nor would

the movements supposed by him lead to the topographical discoveries recorded, while by following the Diary with precision, the author here for the first time demonstrates that the first anchorage of Columbus in the New World was off the south-east point of Watling's Island.

The paper will be published entire, with a map, in the 'Journal,' vol. xli.

Admiral Ommanney said, if there had been no alteration in the names of the islands, this mystery with regard to the landfall of Columbus never would have arisen. It would be advantageous if the hydrographers of the present day would, as far as possible, restore the old Spanish names. He himself was of opinion that the boats went in first, and the ships followed; but all sailors must be very thankful to Mr. Major for the great trouble he had taken in bringing this subject forward.

The Chairman said, if it did not add to actual geographical knowledge, it still was of considerable interest to know the particular point at which the great discoverer first touched; and, as far as an ordinary listener could judge, Mr. Major appeared to have made out his point conclusively.

ADDITIONAL NOTICES.

(Printed by order of Council.)

1. *Letter from the late* Sir John Herschel *on the subject of* Dr. Carpenter's *Paper on Oceanic Circulation.*

A short time previous to his death, Sir John Herschel addressed to Dr. Carpenter the following expression of opinion on the subject of the new explanation of Oceanic Movements contained in Dr. Carpenter's paper in the 'Proceedings of the Royal Geographical Society,' of January 9th. As coming from so eminent a physicist, and one who had given so much attention to this branch of physical geography, the Council consider it desirable to place the letter on record:—

"My dear Sir, "Collingwood, April 19, 1871.

"Many thanks for your paper on the Gibraltar Current and the Gulf Stream.

"Assuredly, after well considering all you say, as well as the common sense of the matter, and the experience of our hot-water circulation-pipes in our green-houses, &c., there is no refusing to admit that an oceanic circulation of some sort must arise from mere heat, cold, and evaporation, as *verœ causæ*; and you have brought forward with singular emphasis the more powerful action of the Polar cold—or, rather, the more intense action, as its maximum effect is limited to a much smaller area than that of the maximum of equatorial heat.

"The action of the trade and counter-trade winds, in like manner, cannot be ignored; and henceforwards the question of Ocean-Currents will have to be studied under a twofold point of view. The wind-currents, however,

are of easier investigation. All the causes lie on the surface: none of the agencies escape our notice; the configuration of coasts, which mainly determines their direction, is patent to sight. It is otherwise with the other class of movements. They take place in the depths of the ocean; and their movements, and directions, and channels of concentration, are limited by the configuration of the sea-bottom, which has to be studied over its whole extent by the very imperfect method of sounding.

"I am glad you succeeded in getting specimens of Mediterranean water near the place of the presumed 'Salt Spring' of Smyth and Wollaston; making it clear that the whole affair must have arisen from some accidental substitution of one bottle for another, or from evaporation. I never put any hearty faith in it.

"So, after all, there *is* an under-current setting outwards in the Straits of Gibraltar.

"Repeating my thanks for this interesting memoir,

"Believe me, dear Sir,
"Yours very truly,
"J. F. W. HERSCHEL.

"*Dr. W. B. Carpenter*, F.R.S."

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2. *Letters from* Dr. J. D. HOOKER, *to* Sir RODERICK MURCHISON, *giving an Account of his Ascent of the Atlas.*

"Camp Hasni, Atlas Mountains, south of city of Marocco,
"MY DEAR SIR RODERICK, "May 17, 1871.

"You will, I am sure, be glad to know that we (my party includes Mr. G. Maw, with whom I planned this trip, and Mr. Ball, who joined us shortly before we started) have succeeded in reaching the crest of the long ridge of the Greater Atlas, which stretches from S.S.E. to S. of the city of Marocco, the eastern end of which was visited in mid-winter of 1829 by our late friend Washington (in company with the late Sir J. D. Hay), and who ascended to 6400 feet when he was stopped by the winter's snow (see 'Journal of the Royal Geographical Society,' vol. i. p. 123).

"Thanks to a representation from Lord Granville, and to Sir J. Drummond Hay's great influence with the Sultan, I received the permission of the latter to visit with my two friends the whole range of the Atlas from a point to the eastward of the city westward to the Ocean, a section included for the most part in the provinces of Entifa, Demenet, Mesfuia, Ourika, Reraia, Imtouga, and Ha'ha, which latter is within a day's journey of the coast at Mogador. Unfortunately the letters of the Sultan were not obtained until I had been for some time in this kingdom, and this, together with the necessity of travelling round by Mogador and the city of Marocco, involved so much delay, that I was most reluctantly obliged to give up the two most interesting (geographically, as being easternmost) provinces of Demenet and Entifa.

"I should premise that, knowing the vehement prejudice against Christians which the Maroccan authorities and people entertain, and the insuperable obstacles the Sultan raises against any attempt on the part of his own people's developing the resources of this country, and the absolute prohibition of Europeans doing so, I promised to confine myself to collecting plants for the Royal Gardens and practising as a Hakim, and engaged that my companions should also confine their attention to plants. I have, therefore, no exact observations, topographical or geological, to offer you, and up to the present time little beyond the bald fact of having reached the crest (not any of the highest points) of the main range visible from the city of Marocco. This

portion has long had the repute of being the loftiest of the whole great Atlas range; but Ball, who has been reading up Rohlfs' Journals, finds that he mentions mountains covered with perpetual snow far to the eastward of this, and which may therefore well be higher, seeing that the climate should be drier to the eastward.

"As regards the section we have now visited, it presents from Marocco city a long ridge, stretching in a W.S.W. direction from S.S.E. to S., and its crest, perhaps, 40 miles distant. It appears of tolerably uniform height throughout its length, apparently about 13,000 feet, steep and rocky in the upper regions, with (now in the middle of May) long streaks of snow descending in deep steep gulleys 4000 to 5000 feet below the tops, and a few patches of snow here and there; but it offers no snow-capped peaks or slopes of any extent, nor glaciers, and what appear to be the loftiest points of the jagged skyline (they hardly deserve the name of peaks) are scarcely snowed at all. To my eye the loftiest part of this section of the range presented a very unpromising prospect, difficult of access, and, considering the nature of the Maroccan climate, barren botanically.

"To the westward of this section there is a considerable depression, but still further west the Atlas rises again into more rounded snow-streaked mountains in the districts of Amsmiz and Siksoua; and this again is succeeded by another depression, and a third group of snow-streaked mountains in the districts of Imtouga and Ha'ha, from whence lower ranges extend to Agadir, on the Atlantic coast south of Mogador.

"Such are the general features of the Atlas chain, as it appeared to me from Marocco city, and along the road to this city from Mogador. Of the loftier Atlas ranges to the eastward of these limits of view I know nothing. There is an isolated conical snowed peak immediately to the east of this section, and I am assured that there are snowy mountains in the province of Demenet, but these latter were not visible to me from Marocco city.

"We left Mogador on the 29th of April, escorted by a captain and a guard from the Governor of Mogador, and, taking the usual route to the capital, arrived there on the 3rd of May, where, after an altercation with the governor of the city—a hater of Christians, who would have lodged us in a filthy hovel—I obtained the Viceroy's permission to occupy the capital house in which Sir Moses Montefiore had been lodged on the occasion of his mission in behalf of the Jews (in 1864), and the garden entrance to which had been bricked up ever since that time. Orders had been already sent by the Sultan to El Grawi, the Governor of the Atlas provinces, who resides in Marocco city, to provide me with letters to the chiefs of the Atlas districts above-mentioned, as also to provide myself and party with a proper guard and with food everywhere.

"We left the city on the 8th, a party of thirty-seven, including two captains and nine soldiers, and directed our steps first south-east, in the direction taken by Washington, viz., to the village of Tassemarout, in the province of Mesfuia. On the second day we were, after two short marches, in the outer valleys of the Atlas, towards the eastern extremity of the snowed range visible from the city, and had an interview with the Caid, or local governor of the province, who holds Christians in aversion, but was civil enough, and accompanied us to Tassemarout. From him we learnt that the snowed ridges were not accessible in his district, and indeed were beyond his rule. How far this was true I cannot say; but, from their distance to the eye, and the excessively rugged nature of the intervening spurs and ridges, I can well believe it. I asked whether any Christian had before visited this country, and was told that a party had done so many years ago, and had gone on from Tassemarout to Tagherain, and returned thence. This, if I remember aright, is what Washington's party did; and it is clear to me that he (Washington)

was wholly mistaken in supposing that he could, in summer, have gained the higher parts of the range from this point (Tassemarout) under several days' journey; and that in winter such a journey would be impossible. Washington's description of the route, and of Tassemerout and its old supposed Christian building—which is a fort on a most commanding height—is very accurate. We did not see the granite boulders at the foot of the hills which he passed on his route back (which was to the eastward), but we passed over a remarkable accumulation of huge water-worn—or weather-worn—sandstone boulders on our route to the base of the range.

From this district (Mesfuia) we proceeded south-west a day's march to the district of Ourika, at the mouth of the river of that name, and at the foot of the mountains opposite the centre of the main range visible from Marocco, and camped by a large village near the river, which, I was told, flows to and supplies the city of Marocco; but this does not agree with the French map, which is compiled from oral information. Here the local Governor was still more hostile to Christians, and kept out of the way; the Sultan's commands as to food, &c., being attended to by a Vice, who was very ungracious. Hence we pushed up the river a few miles, and camped in a lovely very steep valley, leading up to the axis of the chain, which rose in grand snow-streaked cliffs at the top of two valleys, into which the main one divided. The axis was, however, a long way off (at least two days' journey); and though a peasant offered to take us there, our guards refused either to accompany us or to let us go alone, on the grounds that mules and baggage could not go, and that the mountain tribes were independent of the Sultan, and not safe to travel amongst. The real fact I believe to be that the Caid was hostile to Christians, and the soldiers could not *requisition* the needy villagers for the extravagant allowance of food and other supplies (including green tea, sugar, candles, and money) of which they plunder the unlucky chiefs and peasants upon whom the Sultan quarters them in such cases as this. The captain, however, assured us that the snowy mountains were accessible from the province next to the westward (Reraia), and engaged to conduct us to them at once if we would only 'move on.'

I should mention that at Marocco city we could obtain no definite information about the loftier regions of the chain. El Grawi's permission extended to the mountain provinces in general, but to the snows especially in the mountains of Demenet and Reraia, the latter a province from which he draws the revenues; and as both the Mesfuia and Ourika Caids agreed with the captain of our guard in saying that the snows of this section of the range were accessible from Reraia alone, it is very possible that they advised for the best. Be that as it may, we went on south-west to Reraia, and on the second night camped at the place whence I now write, about 4400 feet elevation, and within a six hours' fast walk of the lowest snow now lying. Here we were met by the sheikh of the mountain tribes of this valley, who, after taking us a reconnoitring trip to the first patch of snow (about 8000 feet), a good way beyond the highest village, offered, if we would reduce our party, to get us a house for a night at the latter, and thus allow us to spend more time in the highest parts of the chain. I need not say that we were glad enough to accept his offer.

"Our camp is in an open valley, about midway, roughly speaking, between the Plain of Marocco and the axis of the chain. We are surrounded with olive and walnut groves, and there are, besides, abundance of fig-trees, prickly pear (*Opuntia*), vines, mulberries, and almonds. The native trees are poplar, ash, two junipers, willow, and Callitris (the famous Thuja of the Romans), of which such beautiful articles are made in Algeria. The bushes are lentisks, *honeysuckle*, cistus, elder, rose, alaternus, phillyræa, ivy, bramble, balloot *oak, colutea, and shrubs* allied to the broom. The climate is temperate, and

scenery rather pretty than grand or mountainous, except up the valley, which is backed by the rugged black but snow-streaked crest of the range.

"Above this the valley contracts much, and ascends over rocky spurs gradually for 2000 feet; its flanks are very steep, intersected by ravines, and dotted rather than clothed with small junipers, lentisks, and other brushwood. Along the very narrow floor of the valley the walnut (cultivated) is the principal tree, and extends to 7000 feet, the upper limit of cultivation and of trees: it is indeed the highest tree we saw in the valley, except the juniper; the ash is next below. The alluvial deposits on the lower flanks and base of the valley are carefully terraced and irrigated up to 7000 feet by a very industrious race, spelled Shelloos by Jackson and others (pronounced Sh'lu), who are, however, miserably poor and diseased, giving me too much practice! Their villages are built on rapid slopes, and their houses are square, low, two or three storied erections, of stone below, and a mixture of clay and small stones above; they are flat-roofed, and have open stages in front above. For the most part they are low wretched hovels, without furniture of any kind; those of the highest villages have underground cellars, into which the family retire in the depth of winter. There are many such clay-coloured villages throughout this part of the Atlas, which is populous, and exclusively inhabited by Sh'lus.

"At 6000 feet we came upon the first indubitable signs of old glacial action, in a huge moraine projecting apparently from the flank of a lateral valley, with two smaller moraines nearly parallel with the greater one. The highest rises probably 600 feet above the floor of the valley; all are loaded with enormous blocks of porphyry and other metamorphic rocks, and, except for the walnuts and little terraced fields at their base, are nearly bare of vegetation. Opposite the termination of the largest, nearly opposite a fork in the valley, is a remarkable cone of ice-transported boulders. On the north flank of the uppermost and highest moraine is the miserable hamlet of Arroond, facing the south, *i.e.* the snowy crest of the range, and looking down on a broad flat-floored Alpine-looking valley, partly occupied by terraced well-tilled fields of barley, wheat, rye, and maize (the latter not yet sown), divided by stone dykes, and partly by a gravelly flat through which the river meanders.

"On the following day we proceeded up the valley for a few miles, accompanied by some villagers, and at about 9000 feet fell upon a mule-track which I had seen on our previous visit, and which I was then informed led across the range to the Sous Valley, south of the Atlas (this track is laid down from hearsay on the French map of Marocco). Up this we pushed, leaving our guides at the bottom, not telling them our object, as they had assured me that no one was allowed to go up to the snows above. The ascent was very steep and stony; at 10,000 feet it came on to hail, succeeded by snow. Just below this we met a party descending from the opposite side, laden with goat-skins, who, I suppose, told our people below of our ascent, for the latter immediately followed up and endeavoured to make us return. Money, however, induced them to accompany us, and up we went, always steeply over rocks and débris, whilst the snow fell heavier and greater, till at last it blew a hurricane snowstorm. Mr. Maw was ahead of us by some 200 or 300 feet (for Mr. Ball and I were botanizing), and he alone reached the crest; he could not stay longer than to read his aneroid, and hurried back to us: this gave, by comparison with Ball's, and with the boiling-point, &c., and other observations taken at Arroond, a height of about 12,000 feet. It was impossible to get further: the temperature was 24°—the three men, who had followed us up, and almost resorted to force to make us return for the last 1000 feet of ascent, had bare legs, one had native slippers, but two were absolutely barefooted, and their feet were much cut with the rocks. It continued to snow down to about 8000 feet, and we got back to Arroond drenched. On the following day we descended the valley to this place, through first hailstorms, and then

drenching rain, and found the camp in a clay sludge, and my tent badly set up and leaking frightfully, which must account for some of the *ill looks* of this letter. The whole range is now (20th) heavily snowed down to 7000 feet throughout.

"This is a meagre account of a very interesting region; but beyond the botany of the route, and a little geology which Mr. Maw has diligently kept up, I have no exact information to give of this puzzling range. I should doubt the highest points anywhere much exceeding 12,500 to 13,000 feet, and, if so, probably many points reach 12,500 feet.* The most remarkable feature of the range is the downward extent of the snow in steep, deep northern gullies, to 7500 or 8000 feet, up to the end of the month of May, and more or less throughout the year in latitude 30° N., which snow-streaks are not connected with any snow-fields or snow-capped peaks above.

This is to me an unusual feature, and especially over so long an extent of mountain range. It is no doubt due to the climate and steep contour of the axis, which is now scorched by a blazing sun, now swept by dry Sahara winds, and throughout the year exposed to the very prevalent N.W. oceanic wind laden with vapours that fall as snow and hail-storms. There is thus probably always snow on this part of the Atlas, which it is said to be very rarely seen free from; but there is no perpetual snow proper, in other words, *all the snow that falls annually on fairly exposed surfaces melts in the same year.*

Botanically, the upper (alpine) region is as bare as the middle region is rich; we found no trace of alpine plants, and remarkably few of any kind; few grassy slopes or mossy rocks, not a gentian, primrose, anemone, or any representative of those lovely alpine genera; not even the mountain sorrel (*Oxyria reniformis*), which I found on the Lebanon, and I regard as the typical representative of an Arctic and N. Alpine flora. Considering the nature of the rocks—granite and very hard porphyries—and the climate, I was not much surprised at the absence of alpine plants, and indeed expected a very poor flora. It is true that the higher points may present exceptions, but it is not likely, as we examined carefully the banks of the streams, which in all alpine regions carry down specimens of the plants that grow at higher levels. The rocks also were singularly bare of tufts of vegetation, such as alpine rocks should present, and this even on their shaded sides. Another proof of the dryness of the climate is the great rarity of ferns at all elevations, even in the narrow, fertile, well watered valleys. We have found some half-dozen in all —most of them very sparsely indeed; and all but two, I think, are British.

"The flora of the middle region again is Spanish in type, and is rich, varied, and beautiful; and we shall carry home a splendid herbarium, in point of interest and, I hope, novelty. As presenting the southern limit of the Mediterranean and indeed North Temperate Flora, the Atlas has a special interest, for here many prevalent European types die out, as it were—the ivy, oak, ash, bramble, and some hundred of other British genera, probably exist nowhere to the southward of the Atlas in this longitude; a few may possibly lurk in the valleys of the mountain-range that runs parallel to and south of this, on the opposite side of the Sous Valley, but it is unlikely that many, if any, do so.

"In the poverty of its alpine region the Atlas appears to me to be quite exceptional; the Abyssinian mountain-tops, though equally barren, being lower and less extended. Another curious fact in this range, is the excep-

* Washington, by trigonometry, made the highest point seen from Morocco city, and which is not far from our position, 11,400 feet above the sea; but his calculations depended on a base-line that was very rudely laid down, and the snowed ridges are much farther distant from the foot of the range than he *imagined.*

tionally upward extent of lowland plants; at between 10,000 and 11,000 feet we found many plants of the foot of the range, and even some inhabitants of the hot plains of Marocco. In short, in every point of view the Flora of the great Atlas is excessively interesting; its general nature has long been a botanical desideratum, and I hope we shall clear it up.

I may also mention, for Mr. Bates' information, the rarity of insects in the upper, and indeed all regions. Insects do not fly to the light into my tent at night. Butterflies are very scarce, though I did see a splendid swallow-tail (*P. podalirius*), at 6000 feet. I found no beetles under the stones above 9000 feet; but Mr. Maw turned up a huge scorpion at about 8000 feet, of the same species as that which abounds on the plains, and as this (like our soldiers) must *requisition* extensively, smaller insects must also exist. Birds (and indeed all animal life) seem rare in the higher regions; we saw a few red-legged partridges at 8000 to 10,000 feet.

"Ever, dear Sir Roderick, most sincerely yours,

"Jos. D. Hooker."

"My dear Sir Roderick, "Mogadore, June 6, 1871.

"I wrote to you last from Hasni on the 17th May, since which Mr. Maw has left us (carrying my letter to you), being compelled to return on business: this to my very great regret, as he is not only a capital traveller, but a keen horticulturist and an admirable collector and packer of living plants, and he, further, alone has taken cognizance of the geology of the country we have passed over. You will be glad to hear that Mr. Ball and I have ascended a peak 11,500 feet high, on the Atlas range, to the westward of that whose crest we visited before; and we found it an admirable position, the view extending to the southward, over the Sous Valley, to the range bounding that valley on the south (which may provisionally be called the Anti-Atlas), and which forms the northern boundary of the Wadi Nun Valley.

"To return, however, to where I left off. We reluctantly turned our backs on the beautiful valley of Reraia, and proceeded westward over the northern spurs of the Atlas to the province of Sectana, camping in a position (about 4500 feet) whence we had a glorious view of the Reraia range, now uniformly clothed, down to an elevation of about 7000 feet, with a glittering robe of snow, and this in lat. 31° N., and towards the end of May! What struck me, however, as most remarkable was, that the quantity of snow increased to the eastward; the easternmost mountains of the range, though not more lofty, being clothed more uniformly and to a considerably lower elevation than the western: moreover the western continuation of the Atlas (that between our position and the sea) was even less snowed than before the storm! though this section attains an elevation of 12,000 feet at least, and is much nearer the source of the humidity and in the way of its transporting agents (the sea and north-west wind respectively) than the eastern range. It had evidently rained in the western range whilst it snowed in the eastern,—a fact probably attributable to the mountain mass of the latter being much greater.

"From this point of view (Sectana) it was evident that it would be easy to ascend the section of the Atlas south of Marocco, from its south-west end, in a district which we were assured was under the jurisdiction of a local chief through whose territory we should pass on the morrow, and to whom we had letters from El Grawi. These, however, availed us nothing: the old chief was altogether hostile to Christians, and inhospitable to boot; wished us to pass on through his territory without even seeing us, and, though forced to be civil according to the Sultan's commands, would not admit us to his mountain valleys.

"*From his* province we travelled on westwards to that of Amsmiz, crossing,

the Wad en Fys, the principal feeder of the Temsift, and whose head-waters are collected in the depression that separates the section of the snowy range we had visited from that next to the westward. The Governor of the Amsmiz province is a vassal of El Grawi's, and received us with hospitality; his castle, near a large village and mart, is at the foot of the Atlas, and some 3500 feet above the sea. He professed the utmost readiness to forward our views, which were to examine the highest peak visible up the valley he governed, and for this purpose sent for the sheikh of the valley, whom he instructed to accompany and feed us.

"As on the previous occasion, we had to leave the camp at the foot of the mountains, take a very small party up, and lodge in a villager's hut. The snowy axis here approaches to within some 15 miles of the foot of the mountains, and consists of more isolated tops, and far less steep ridges, though snowed as low in the gulleys, viz., to 8000 feet on northern exposures. The flanks of the valley, also, are less rocky, and quite bare, in most places, of forest or brushwood, the latter usually represented by starved trees and bushes of lentisk, cistus, Balloot oak, juniper, and Aleppo pine (the latter rare). The floor of the valley is, as usual, very narrow, clothed with walnut and olive cultivation, and threaded by a brawling stream. The villages, inhabited by Sh'lus, were very poor, many of them in ruins, owing to the frequent petty wars waged by the villagers, and the oppression of the Government and chiefs, who levy iniquitous imposts on the inhabitants, and revenge their inability to pay them by devastating their crops and burning their houses. Our sheikh turned out to be a very different man from his master. We found him first taciturn, then obstructive, and, lastly, deceitful; he had warned all the inhabitants against us as Christians, and, to our surprise, we could not get a smile or salutation, nor a civil answer from a native, the whole way up the valley. After taking us some 6 or 8 miles, he halted at a village at about 4500 feet, and told me this was the highest we could reach and be accommodated; and that we were permitted to wander about the slopes, but must not go higher; and that the snowy range beyond was inaccessible because of hostile tribes, and not under the Sultan's authority. After a long altercation, he yielded to a threat to return and report him at Marocco, and offered to take us on on the morrow with a guard of 50 armed men. Knowing that this was all nonsense, I told him that it was immaterial to me whether he took 50 men or none, that was his lookout, for that we were prepared to go alone, or with any party he pleased, but that we must ascend the lofty snowed peak at the head of the valley on the morrow. We spent the afternoon botanizing about the village, finding a far poorer vegetation than in the Reraia Valley, and (with the exception of the Jews, who swarm in every village and town of this kingdom) a very uncivil population, who would not even come for medicine, though sick and diseased abounded in every part of the valley.

"Early on the 21st May the sheikh was prepared to escort us to the highest peak at the head of the valley; his armed escort of 50 having dwindled down to 5 men, with scarce a musket amongst them. Our route lay along the bottom of the valley for some 8 or 10 miles northward, through groves of walnut and olive, or along little terraced fields of wheat, barley, beans, &c. At the foot of the mountain, elevation about 6000 feet (which we were told was called Djebel Tezah), the valley forks; and here the sheikh and his men made off, leaving us with a sinister-looking Sh'lu from a neighbouring village, who was instructed to take us up to the snow, but, as it turned out, to oppose our going further. The ascent was not steep; we reached the first snow in a broad steep gully at about 8000, and followed it up to 11,000 feet; the top—a blunt conical mass of slaty rocks—was wholly unsnowed, and, as determined *by Ball (by comparison* with observations at Mogadore), just over 11,500 feet *above the sea*. The view was superb, northward of the valley we had

ascended, and the plain of Marocco covered with dense banks of clouds. Eastward, the Reraia range we ascended on the 16th, probably 20 miles off in a straight line, was still heavily snowed, though much had melted since we were there. Between us and this was the broad valley of the feeders of the Wad en Fys, occupying a depressed basin of low mountain ranges that extended far behind the mountain we were upon, and also to the south-west of it. Over this depressed area, along the far horizon, stretched the long pale grey range of mountains across the Sous Valley (the aforesaid Anti-Atlas), from E.S.E. to nearly S.W. It was very indistinct, the distance being so great: its sky-line was tolerably uniform, low on the horizon, and undulating; the only rugged portion bore about S.S.E. Westward the Atlas rose in black, rugged, furrowed ridges, continuous with the peak we occupied, to perhaps 12,000 or 12,500 feet.

"The valleys of the upper feeders of the Wad en Fys occupy an area, probably, not less than 20 miles broad, and of considerable depth. They are inhabited for the most part by independent tribes of Sh'lus, and we saw many hamlets with patches of cultivation up to 7000 feet, and gulleys clothed with the vivid green of the walnut tree. Of forest proper we saw none in this or any other part of the range visited before or since; the Moors and Arabs have, no doubt, destroyed the forests throughout the greater part of the kingdom of Marocco, and here, as elsewhere, clumps of brushwood and isolated stumps—chiefly of oak, callitris, juniper, carob, and ash—often of considerable diameter, are all that remain of primæval woods. A ragged belt of starved oaks marks the limit of the former forests, occupying the very steep, and often rocky, extremities of the spurs at 8000 to 9000 feet elevation.

"Notwithstanding the low elevation of the snow patches, the climate would appear to be a very dry one. Ferns were extremely scarce, and the plants of Djebel Tezah were almost uniformly the same as those we had gathered at similar elevations in the Reraia valley. Low prickly herbs and shrubs prevailed, amongst these the common wild gooseberry, a rose, and a Berberis, very near the Ætna species; all these occurred at 10,000 to 11,000 feet elevation. The only plant at all recalling our Alpine Flora that we found above 9000 feet was a small *Draba*, like *D. aizoides* (a sub-alpine European species). This all but identity of vegetation with that of the mountains previously ascended quite disappointed me, for the geological structure and contour of Djebel Tezah were wholly different: those were rugged limestones, porphyries, and granites; this of far smoother slopes of schistose slates with intruded bosses of red porphyry. The weather being very fine I found a few more insects, and a beetle or two for Mr. Bates under the stones, near the top, but only after diligent searching.

"We descended steeply and by different routes, so as to lose no chance of adding to our collections, but to little purpose; and though a few more species might, at a later season, be added to the Flora of these lofty regions, I am forced to conclude that they are the most barren of their height and position that I ever visited; even mosses and lichens were extremely poor and rare, compared with what other alpine and sub-alpine regions present: the only ferns are those of dry climates, and the plants typical of the region are for the most part isolated members of large and widely distributed genera. One instance is as good as a hundred (and this one better, too), that of *Saxifraga*, of which so many fine species occur in the Mediterranean region. Of it we found but three in the whole Atlas, and all sparsely. Two are universally distributed European (and English) species, *S. tridactylites* and *S. granulata*, and the third, *S. globulifera*, is a native of Spain. The comparative rarity of succulent plants, which abound in Southern Europe, Madeira, and the Canaries, is equally remarkable; and we have not found any of the more peculiar genera of the Canary Island Flora, not even the dragon tree, which

extends to the Cape de Verd Islands. Much, or all is, no doubt, due to the abnormal coolness of the Maroccan climate, and the sudden transitions from wet to dry to which the Atlas is exposed.

In respect of temperature, we found Marocco to be far cooler at this season than Spain, Italy, or Algeria; due partly to the great elevation of the central mountain masses, but far more to the prevalent northerly winds that blow perennially along the whole coast, and the current of cold water, also from the northward, that sets along it. The thermometer, at from 1000 to 3000 feet on the plains near the hills, in May rarely rose above 70°, and the nights were very cool. Then with respect to the climate of the Atlas itself, it must be powerfully affected by the violent snow-storms and hurricanes with hail, that infest it during a greater part of the year; for, to whatever causes the precipitation of snow and hail are proximately due, these are most prevalent over the Atlas chain, and are connected with the sharp contrast between the essentially northern and cool climate of the countries facing its north and west flanks, and the essentially dry, hot, and Saharan climate of the countries facing its south and east flanks, giving rise to frequent and sudden atmospheric disturbances.

It follows that the Atlas should be often clouded, and we found this to be the case throughout our journey. For days together we never saw their crests; and, indeed, from our arrival at Mogadore, 26th May, till leaving the country on the 6th June, we so rarely saw the mountains, that we were wholly unable to lay down, even approximately, either the position of those we had ascended, or the direction and extent of the successive ranges, they having been so frequently and continuously obscured either by clouds of humidity or by an impenetrable haze.

"Low as is the latitude of Marocco its vegetation shows that the North Atlantic determines its climate, favouring the dispersion of northern types up to the tops of the Atlas, and forbidding the entrance of the southern forms, that elsewhere prevail in similar latitudes (in Egypt, Arabia, and N. India), and some of which reappear even in the heated plains and valleys of Spain, seven or eight degrees further north. Until, however, we know something of the climate and productions of the Sous Valley to the south of this part of the Atlas, and of the desert country on its eastern flanks (towards Tafilet, &c.), it is vain to speculate further. Into those countries no Christian, known as such, can set foot except at the peril of his life, and with the certainty of instant expulsion. The few plants that have been brought thence, or noted there, are chiefly tropical and desert types.

From Amsmiz we continued along the base of the Atlas, through the provinces of Mzouda and Duerana, to that of Siksawa, when we hoped again to have ascended to the central ridges, but were defeated in our object through the treachery of the captain of our guard, conjointly with the hostility of the sheikh of the valley, who we further found in open and actual hostilities with a neighbouring village; to the alarm of our valiant soldiers, who would fain have run away. We, however, made some minor ascents, and obtained a general idea of the character of the chain in this longitude (about 8° w.), where there is another broad depression, through which the road runs from Marocco to Tarodant, in the Sous Valley,—a place once of immense commercial importance, and still one of great resort.

"From Siksawa we went on to the next province of Imtouga, which we found at open war with that next to the westward of Ha'ha, which extends to Mogadore. The Governor of Imtouga had orders to let us visit the snows of his province, and from his known friendliness to the English would, no doubt, have done so, but the mountain tribes were up in arms, and he dared not send his own troops amongst them. At the same time we received instructions from our excellent friend Mr. Carstensen, the Vice-Consul at Mogadore, on no account to enter Imtouga, for that a levy en masse was

called out in Ha'ha; but to turn north and meet him at Shedma, and so return to Mogadore. We were, however, in Imtouga, and so pushed on and through it, staying a night at the Governor's castle, after a grand battle had been fought and a good many killed on both sides. The Imtouga people claimed the victory, of course; and we saw 24 prisoners being driven in and cruelly maltreated—probably innocent villagers, seized to give *éclat* to the return of the victorious troops.

"Thence we went northward to Shedma, the province east of Mogadore, and thence north again to the Djebel Hadid (Iron Mountains), which we ascended; finally we turned south to Mogadore, arriving on the 3rd of June.

"As there was no boat for the northward for some days, we hoped to have got a guard and made our way southward into Ha'ha; but the whole country was in arms. The people, who are all Sh'lus, had risen against the Governor—a cruel and despotic barbarian—and attempted to depose him, and the war with Imtouga progressing all the while. Bands of robbers began to infest the country, and camels were stolen, and murders were committed under the very walls of Mogadore.

"Thus ended our little excursion. My collections are all safe here, and will, I hope, elucidate the Flora of a hitherto almost unknown region. My Herbarium is largely indebted to Ball's activity, keen sight, and admirable knowledge of the European, and especially the Mediterranean Flora. I think I never met his equal as a plant-hunter; he also has taken most of the altitudes (all, indeed, since Mr. Maw left) with an aneroid of Secretan's, checked in the Reraia valley by a good boiling-point apparatus and comparison with observations taken by Carstensen at Mogadore.

"I have said little about the people of this barbarous country. Of these, the Moors and Arabs are vile beyond a proverb: the Sh'lus would, if well governed, be a fine people, and would rapidly improve and take to commerce; meanwhile they are very poor, grievously oppressed, suspicious, distrustful, and bigotedly opposed to Christians as such. Both Moors and Sh'lus are often crossed with Negro blood, and by one another, so that it is difficult to distinguish them, though the Sh'lus usually wear a dark brown, or black, cloak, the Jellabya (or burnous of other Arab countries), with a curious transverse elliptic area of bright colours at the back above the calves of the legs. The Jews are a far superior people to the Moors, amongst whom they mix freely, and enjoy various privileges, despite their being cursed and despised. In fact they enjoy great immunity from oppression compared with what both the Moors and Sh'lus experience. In war time, however, they suffer frightfully; having most to lose, and no power of combination for self-protection. Were the Jews replaced by English, the whole country would be English in a week.

"The Government is despotic, cruel, and wrong-headed in every sense; from the Sultan to the lowest soldier all are paid by squeezing those in their power. Marocco itself is more than half ruinous, and its prisons loaded; the population of the whole kingdom is diminishing; and what with droughts, locusts, cholera, and prohibitory edicts of the most arbitrary description, the interior is on the brink of ruin; and but that two-thirds of the kingdom is independent of the Sultan's authority, being held by able mountain chiefs who defy his power to tax or interfere with them, and that the European merchants maintain the coast trade, and the Consuls keep the Sultan's emissaries in check, Marocco would present a scene of the wildest disorder.

"Ever dear Sir Roderick,

"Most sincerely yours,

"J. D. Hooker."

3. *Results of the Examinations of* 1871 *for the Prize Medals offered by the Royal Geographical Society to the principal Public Schools of the United Kingdom; Report of the Examiners for* 1871; *and Programme for* 1872.

LIST OF SCHOOLS INVITED TO COMPETE IN 1871.

English Schools.—St. Peter's College, Radley, Abingdon; King Edward's School, Birmingham; Brighton College; Cathedral Grammar School, Chester; Cheltenham College; Clifton College; Dulwich College; Eton College; Haileybury College; Harrow; Hurstpierpoint; Liverpool College; Liverpool Institute; London,—Charter House; Christ's Hospital; City of London School; King's College School; St. Paul's; University College School; Westminster School; Royal Naval School, New Cross;—Manchester School; Marlborough College; University School, Nottingham; Repton; Rossall; Rugby; King's School, Sherborne; Shoreham; Shrewsbury; Uppingham School; Wellington College; Winchester School.

Scotch Schools.—Aberdeen Grammar School; Edinburgh Academy; Edinburgh High School; Glasgow High School.

Irish Schools.—Royal Academical Institute, Belfast; Dungannon Royal School; Ennis College; Portora Royal School, Enniskillen; Foyle College, Londonderry; Rathfarnham, St. Columba's College.

Ten of the above Schools furnished competitors, according to the following list, in which is entered the number of candidates in Political and Physical Geography from each school:—

	Physical.	Political.
King Edward's School, Birmingham	1	0
Clifton College, Clifton	3	2
Liverpool College	4	1
Liverpool Institute	1	0
City of London School	2	0
Dulwich College	1	0
University School, Nottingham	0	1
Rossall School, Fleetwood	3	2
King's School, Sherborne	4	0
Uppingham School	1	1
	20*	7

The Examiners appointed by the Council for 1871 were Dr. W. B. Carpenter, M.D., F.R.S., Registrar of the University of London, for Physical, and C. H. Pearson, Esq., M.A., Fellow of Oriel College, Oxford, and Lecturer on History in Trinity College, Cambridge, for Political Geography; the papers set by these gentlemen were as below. The examinations were held at the various schools, on the 27th of March, and the results were announced at the Anniversary Meeting of the Society on the 22nd of May.

PHYSICAL GEOGRAPHY.

No. 1 EXAMINATION PAPER, 1871.

A. Configuration of the Earth.

[N.B. *Credit will not be given for Answers to more than* FOUR *of the Questions in the First Section, and* EIGHT *in the Second.*]

1. What are the distances in geographical miles, measured in a direct line, between (*a*) Dublin and Constantinople, (*b*) Pekin and Calcutta, (*c*) Quito and

* *Of these, two* were withdrawn through illness or other causes:—one belonging to *Rossall School, and* one to King's School, Sherborne; leaving the numbers actually competing, *eighteen in* Physical, and seven in Political Geography.

Rio Janeiro? Represent in section the great features of the country traversed by each of these lines.

2. An Arc of Parallel has been measured in N. lat. 52° between Valentia and the Ural Mountains. What is the length of this arc in degrees of longitude and in geographical miles? Mention six places of importance which lie in or near its line, giving their respective distances from either end of it.
3. It is said that "On the British Empire the sun never sets." Show how this is the case; and state what is the local time in the capital of every principal British colony and dependency, when it is noon at Greenwich.
4. What is the mean elevation above the Sea-level of the following Continents:—Europe, Asia, North America, South America? Account for the fact that the level of the sea is 515 feet higher at Kurrachee (at the mouth of the Indus) than it is at Cape Comorin.
5. Specify the principal Mountain-systems of Europe and Asia, stating the range and direction of each, the side of its steepest slope, and the height of its loftiest summit.
6. What are the principal areas in which the level of the Land is *below* that of the Sea? Describe the boundaries of each, and state its greatest amount of depression, with that of any inland sea or lake it may include.

B. General Physical Geography.

7. What proportion does the total area of the known Land of the globe bear to that of the Sea? Supposing the globe be so divided into two hemispheres, that one contains the *maximum* and the other the *minimum* of land, what land will each hemisphere include, and where will its Pole lie?
8. What is the mean elevation of the line of Perpetual Snow under the Equator, and on the principal mountain-chains of each hemisphere?
9. Specify the principal *Volcanic Areas*, and name the chief active volcanoes in each.
10. Give a general account of *Coral Formations*, distinguishing their four kinds, and mentioning examples of each.
11. What circumstances indicate that in the Pacific and Indian oceans there are *Areas of Elevation* and *Areas of Subsidence*? What are the principal islands included in each?
12. What is meant by a *Delta*? On what conditions does its formation depend What are the principal deltas now in progress?
13. What is meant by the *Variation of the Compass*? What differences in it are observable (*a*) at different parts of the Earth's surface, and (*b*) in the same place at different times.
14. What is the cause of *Tides*? What do you mean by *spring* and *neap* tides? [This part of the answer may be illustrated by diagrams.] Mention localities in which tidal changes are *most* and *least* conspicuous.
15. Describe the direction and extent of the principal *Oceanic Currents*.
16. What are *Trade Winds* and *Monsoons*? Where do they respectively prevail? How are they accounted for?
17. Show how the slope of a lofty mountain between the Tropics presents an epitome of the *Flora* (or collective Vegetation) of a hemisphere. Into how many distinct floral zones may it be divided?
18. What are the chief peculiarities of the *Fauna* (or collective Animal life *) of the Indian Archipelago; and by what Races of Man are its principal islands peopled?

No. 2 Examination Paper, 1871.

Physical Geography of British North America.

[N.B. *Credit will not be given for Answers to more than* EIGHT *of the Questions in this Paper.*]

1. Describe the Mountain-systems of the western portion of British North America, specifying the heights of their principal peaks and passes.

* *It is expected* that mention should be made of the most remarkable Land Animals *of every kind*, and of what is specially noteworthy in their Geographical distribution.

2. What systems of Stratified Rocks more ancient than the Silurian are found in Canada; where do they occur, and what are their equivalents in Europe?
3. What large lakes lie wholly, and what partially, within British North America? Describe the position of each, and state, approximately, its area, its height above the sea-level, the principal streams it receives, and its mode of communication (direct or indirect) with the sea.
4. Describe the whole course of the stream of which the lower part is known as the River St. Lawrence, and mention the chief tributaries it receives.
5. Draw a map of Hudson's Bay, with its northern outlets, as far as the Arctic Circle.
6. Describe the whole course of the streams of which the lower parts are known respectively as the Nelson River and the Frazer River.
7. What are the principal differences between the climate of Canada and that of Great Britain? How do you account for those differences?
8. What are the most important Mineral products of British North America, and where do they respectively occur?
9. Describe the position, area, and physical features of Newfoundland; compare its climate with that of England and of Canada, and mention the chief circumstances that modify it. What are the chief products of the Fisheries in its neighbourhood?
10. What Vegetable products, either wild or cultivated, are most abundantly furnished by British North America? How are these conveyed to harbours of export?
11. What are the principal native Mammals and Birds of British North America? Where do they severally abound? What articles of value to Man do they respectively furnish?
12. Describe the two principal native Races of Man that are found in British North America, specify the parts of the country occupied by each, and mention indications of their community of origin, and of their relationship to Asiatic races.

POLITICAL GEOGRAPHY.

No. 1 Examination Paper, 1871.

General.

[*Twelve of the Questions set are to be answered, and the Student must try to answer some in each of the Classes distinguished by the letters* A, B, C, *and* D.]

A 1. Give the latitude and longitude of Rome, New York, Constantinople, Algiers, Melbourne, Bombay, and Canton.

A 2. Give the distance in geographical miles between Paris and Berlin, and say what places of importance lie between them.

A 3. What was the old sea-route between London and Melbourne in Australia, for vessels rounding the Cape of Good Hope, and why has it been changed?

A 4. If a Russian army were to attempt the conquest of India, what route would it be likely to follow? what places of importance would lie on its way? and what would be the distance between the nearest point in Russian territory to the nearest point in British India?

A 5. Give the relative areas of France, North Germany, Great Britain and Ireland, and Spain; of Sicily, Iceland, Ireland, Cuba, and Borneo.

A 6. Compare the courses of the Nile, Rhine, Danube, Volga, and Mississippi; giving the length of the rivers respectively, and the distance, in a straight line, from the source of each to its outflow, and stating for how many miles each is navigable.

B 7. What were the limits of the Roman Empire at the time of its greatest extent?

B 8. Compare the possessions of England and France in 1330, 1560, and 1764.

B 9. What were the Spanish dominions at the time of their greatest extent?

B 10. Draw a map showing the territories that were subject to the Swedish Crown.

at the time when Gustavus Adolphus engaged in the Thirty Years' War; or a map of Italy in 1850, showing between what different powers it was divided.

B 11. What were the dominions of Prussia in 1739 and 1816 respectively?

C 12. What causes have made Tyre, Carthage, Alexandria, Venice, Antwerp, London, and New York, great commercial centres?

C 13. What routes does commerce between China and India follow at present, and what new ones may be opened up?

C 14. What are the advantages and disadvantages of the routes to Canton by the Suez Canal, by San Francisco, by Cape Horn, and by the Cape of Good Hope respectively?

D 15. What natural circumstances mainly determine the density of population in a country, or contribute to the civilisation of its people? Is there any difference in these respects between ancient and modern times? Give illustrations.

D 16. What has been the influence of the principal mountain chains of Europe on political boundaries?

D 17. Is there any country that could furnish itself within its own boundaries, and without trade or colonies, with salt, sugar, tea, coffee, wine, wool, cotton, coal, copper, quicksilver, iron, gold, sulphur, and nitre? If you know of none that altogether fulfil these requirements, mention such as most nearly do so.

D 18. What are the geographical reasons for the different developments of England, Scotland, and Ireland?

No. 2 Examination Paper, 1871.

Special.

[*Eight of the Questions set are to be answered.*]

1. Give a map of the British dominions in North America.
2. In what order, and by whom, were the different territories discovered?
3. What Indian tribes inhabited the present Dominion of Canada when it was first explored in the 16th century, and what parts did they severally occupy?
4. How far was the policy of France in North America, down to 1763, determined by the character of the country, and by that of French colonisation?
5. What are the boundaries and chief towns of historical interest in Nova Scotia? How far does it correspond to the ancient Acadia?
6. At what periods did we acquire our different territories? Give the boundaries in each instance: and say if any differences in the populations of the respective districts are due to the manner of acquisition.
7. For what military events are the Bay of Gaspé, Quebec, Montreal, Michilimackinac, Queenstown, Toronto, St. Eustache, and Navy Island, severally famous?
8. What were the territories lately ceded by the Hudson's Bay Company? What will be the probable consequences of their annexation to Canada?
9. Why has a large party in the Province of Nova Scotia opposed the plan of incorporation with Canada, and what are the geographical difficulties in the way of carrying out a complete union?
10. In choosing a capital for Canada, what were the several reasons for Quebec, Montreal, Toronto, and Ottawa; and which was actually chosen?
11. What will be the probable line of communication between Quebec and Victoria? What is the distance between these two cities, and what towns of importance lie on the route?
12. Compare the natural resources of the British dominion with those of countries in corresponding latitudes in Europe and Asia.

The following are the names of the successful competitors:—

PHYSICAL GEOGRAPHY.

		Age.	
Gold Medal ..	DANIEL MCALISTER	16 ..	Liverpool Institute.
Bronze Medal ..	WM. GERSHOM COLLINGWOOD	16 ..	Liverpool College.

Honourably Mentioned.

		Age.	
Equal	ROBERT ALEX. LUNDIE	15	*Liverpool College.*
Equal	WILLIAM NAPIER SHAW	17	*King Edward's S., Birmingham.*
	WILLIAM CLARK HUDSON	16	*Liverpool College.*
	FREDERICK J. BECKLEY	18	*King's School, Sherborne.*
Equal	THOMAS DISNEY	17	*Rossall School.*
Equal	WILLIAM ERNEST EVILL	18	*Clifton College.*
Equal	HORATIO R. F. BROWN	17	*Clifton College.*
Equal	WOODFORDE B. FFOOKS	17	*Clifton College.*

POLITICAL GEOGRAPHY.

		Age.	
Gold Medal	GEORGE HOGBEN	—	*University School, Nottingham.*
Bronze Medal	RICHARD NAYLOR ARKLE	15	*Liverpool College.*

Honourably Mentioned.

	Age.	
FRAS. MONKHOUSE SPARKS	17½	*Rossall School.*
J. B. HEATH	18	*Clifton College.*
DOUGLAS SAMUEL BONTFLOWER	17½	*Rossall School.*
ARTHUR HASSALL	17	*Uppingham School.*

REPORTS OF THE EXAMINERS FOR 1871.

I.—PHYSICAL GEOGRAPHY.

To the Council of the Royal Geographical Society.

GENTLEMEN,

I have the honour to report that the number of Papers submitted to me in Physical Geography is eighteen;—that the names of the two highest Candidates are:—

1. **Gold Medal** .. DANIEL MCALISTER.
2. **Bronze Medal** .. WILLIAM GERSHOM COLLINGWOOD.

And that the following are worthy of honourable mention:—

Equal ROBERT ALEXANDER LUNDIE.
Equal WILLIAM NAPIER SHAW.
WILLIAM CLARK HUDSON.
FREDERIC J. BECKLEY.
Equal THOMAS DISNEY.
Equal WILLIAM ERNEST EVILL.
Equal HORATIO R. F. BROWN.
Equal WOODFORDE B. FFOOKS.

As in last year's Examination, the proportion of good papers in the special subject is greater than in the general subject. It is obvious that there are certain great features in the physical geography of British North America, which would almost necessarily form a principal part of the topics of the Examination; and these have in general been very fairly mastered. I have not thought it right, however, to make honourable mention of any candidate who has not also acquitted himself well in the General paper. The remarks of the Examiner on the character of the answers last year seem to have kept away many ill-prepared candidates. There are only two who show an absolute deficiency in the knowledge required.

The Council may have observed that certain questions were set in the General paper beyond the range of ordinary book-knowledge; and may be interested in learning the result.

Question 2 was attempted by only *three* candidates; and only *one* answered it with an approach to accuracy.

Question 3 was attempted by only *four* candidates; and only *one* answered it tolerably.

The second part of Question 4, which was set as a "rider" to the first, was not answered correctly by any candidate. Not one seems to have had an idea of the northerly attraction exerted by the elevated land of Asia, which the form of the question was intended to suggest.

Question 11 was only attempted by *one* candidate, although Question 10 was very well answered by several. Considering the geological importance of the doctrine based by Mr. Darwin on his study of Coral Formations, its neglect is to be regretted.

Question 18 was attempted by *five* candidates, and was fairly answered by *three*.

I may mention as a reason for putting these questions, that the limitation desired by the Council in the number to be answered in each division of the paper, seemed to suggest that an opportunity should be given to candidates whose studies have extended beyond the ordinary Text-books, to display their proficiency.

WILLIAM B. CARPENTER,
Examiner in Physical Geography.

April 17*th*, 1871.

II.—POLITICAL GEOGRAPHY.

GENTLEMEN, Trinity College, Cambridge, April 27th, 1871.

I have already sent in a list of the marks got by the different candidates for the Medals of the Royal Geographical Society. HOGBEN is much ahead of any of his competitors, and has written very business-like papers. ARKLE has done very even work; and SPARKS, who appears to have some personal knowledge of parts of British North America, has written very fully on that subject; and might, I think, have stood slightly higher than he does, if he had abstained from introducing irrelevant matter. The candidates, with one exception, seem to have prepared themselves carefully. The maps, however, are in no case quite as neat as they ought to be.

Every question in the two papers has been attempted by some one. In the first paper, the questions worst answered were those that required some thought, as, for instance, the four marked D, and the one or two that demanded very exact knowledge, such as A 1. In the second paper, the differences between man and man were very great; but, as a rule, the candidates had taken very little pains to study the history of the various provinces.

I am disposed to think that the objects of the Society would be more completely attained, if a list of books that would be found useful were given when the subjects for examination are set. I am aware that it is extremely difficult to recommend good text-books, or perhaps undesirable to confine the reader to one or two. But I think these objections are overbalanced by the fact that the President and Council are much more competent to indicate good sources of information than the teachers or relatives whom the boys must commonly consult. Nor would it, I think, be necessary to restrict the candidates to the use of particular text-books. It must often be possible to indicate several that treat of the same subject.

CHARLES H. PEARSON,
Examiner in Political Geography.

PROGRAMME FOR 1872.

THE Council of the Society have satisfaction in repeating the offer of Prize Medals for the ensuing year, and have invited the following Public Schools to take part in the competition :—

LIST OF SCHOOLS INVITED TO COMPETE IN 1872.

English Schools.—St. Peter's College, Radley, Abingdon; King Edward's School, Birmingham; Brighton College; Cathedral Grammar School, Chester; Cheltenham College; Clifton College; Dulwich College; Eton College; Haileybury College; Harrow; Hurstpierpoint; Liverpool College; Liverpool Institute; London,—Charter House; Christ's Hospital; City of London School; King's College School; St. Paul's; University College School; Westminster School; Royal Naval School, New Cross;—Manchester School; Marlborough College; University School, Nottingham; Repton; Rossall; Rugby; King's School, Sherborne; Shoreham; Shrewsbury; Stonyhurst College, Blackburn; Uppingham School; Wellington College; Winchester School.

Scotch Schools.—Aberdeen Grammar School; Edinburgh Academy, Edinburgh High School; Glasgow High School.

Irish Schools.—Royal Academical Institute, Belfast; Dungannon Royal School; Ennis College; Portora Royal School, Enniskillen; Foyle College, Londonderry; Rathfarnham, St. Columba's College.

Syllabus of Examinations for the Prize Medals of the ROYAL GEOGRAPHICAL SOCIETY *in* 1872.

EXAMINATION IN PHYSICAL GEOGRAPHY.

This Examination will take place simultaneously at the several invited Schools, according to printed regulations (which will be forwarded in due time), on the fourth Monday in March, 1872, and will consist of two papers of three hours each; the one to be answered between 9 and 12 A.M., and the other between 2 and 5 P.M.

No. 1 *Examination Paper* will consist of questions on the following subjects :—

A. *Configuration of the Earth*, as learnt by careful study of a globe. What are the distances, speaking roughly, between such remote places as may be specified? What places of importance lie on the direct lines between them, and what is the section along each? What are the relative size, elevation, &c., speaking roughly, of such well-known districts, mountains, and rivers, as may be specified?

B. *General Physical Geography.*—Distribution of land and sea, forests, plateaux, glaciers, volcanoes, man, animals, plants and minerals, climates and seasons, oceanic, meteorological and magnetic phenomena.

*** Extra marks will be allowed for sketches, but only so far as they are effective illustrations of what cannot otherwise be easily expressed. No marks will be given for neatness of execution, apart from accuracy.

No. 2 *Examination Paper* will consist wholly of questions on a special subject.

The special subject appointed for 1872 is—

The Physical Geography of South America and the adjacent Islands, Trinidad, Galapagos, Falkland Islands, and Tierra del Fuego.

EXAMINATION IN POLITICAL GEOGRAPHY.

This Examination will take place simultaneously at the several invited *Schools, at the same* hours and under precisely the same regulations as those *in Physical Geography.*

No. 1 *Examination Paper* will consist of questions on the following subjects:—

A. *Descriptive Geography.*—Explanation of latitude and longitude. What are the distances in geographical miles, speaking roughly, and as learnt by the careful study of a globe, between such remote places as may be specified? What places of importance lie on the direct line between them? What is the relative size, speaking roughly, of such well-known countries, mountains, and rivers, as may be specified?

B. *Historical Geography.*—Embracing (1) the boundaries of states and empires at different historical periods; (2) the chief lines of commerce, ancient and modern; (3) the influence of geographical features and conditions upon the distribution of races and political history of mankind.

No. 2 *Examination Paper* will consist wholly of questions on a special subject.

The special subject appointed for 1872 is—

Geography of South America and the adjacent Islands, Trinidad, Galapagos, Falkland Islands, and Tierra del Fuego.

*** Extra marks will be allowed for maps and sketches, but only so far as they are effective illustrations of what cannot otherwise be easily expressed. No marks will be given for neatness of execution, apart from accuracy.

The following books contain much information regarding the various countries of South America:—

*Humboldt's 'Personal Narrative.' (English translation.) London. Bohn. 1852. 3 vols., 15*s.*
*Humboldt's 'Views of Nature.' London. Bohn. 1850. 1 vol., 5*s.*
Dalton's 'History of British Guiana.' Longmans. 1855. 2 vols., 32*s.*
De Verteuil's 'Trinidad.' London. Ward and Lock. 1858. 1 vol., 21*s.*
*Bates's 'Naturalist on the Amazons.' London. Murray. 1864. 1 vol., 12*s.*
Gardner's 'Travels in the Interior of Brazil.' London. Reeve. 1846. 1 vol., 12*s.*
Fletcher and Kidder's 'Brazil and the Brazilians.' 6th Ed. London. Sampson Low and Co. 1 vol., 18*s.*
Markham's 'Travels in Peru,' &c. London. Murray. 1862. 1 vol., 16*s.*
Page's 'La Plata: Argentine Confederation and Paraguay.' New York. Harper. 1 vol., 18*s.*
*Darwin's 'Journal of Researches into the Natural History and Geology of Voyage of the *Beagle*.' London. Murray. 1 vol., 9*s.*
Martin's 'Statesman's Year Book.' London. Macmillan. 1 vol., 10*s.* 6*d.*
Mrs. Somerville's 'Physical Geography.' (Latest edition.) London. Murray. 9*s.*

Prince Adalbert's 'Travels in Brazil,' &c. (English translation.) London. Bogue. 1849.
Von Tschudi's 'Travels in Peru,' &c. (English translation.) London. 1847. 1 vol.
Sir Woodbine Parish's 'Buenos Ayres and the Provinces of the Rio de la Plata.' London. Murray. 1852.
Weddell, H. A., 'Voyage dans le Nord de la Bolivie.' Paris, 1853.
Demersay, L. A., 'Histoire Physique, Economique et Politique du Paraguay.' Paris, 1860.

*** Those marked with an asterisk (*) are especially recommended, but it is to be understood that no exclusive preference will be given to them in the *Examination*.

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4. *Copy of a Letter sent to the* VICE-CHANCELLORS *of the* UNIVERSITIES *of* OXFORD *and* CAMBRIDGE *from the* PRESIDENT *and* COUNCIL *of the* ROYAL GEOGRAPHICAL SOCIETY.

"15, Whitehall Place, London,
"SIR, "3rd July, 1871.

"Our attention has been directed to a scheme, initiated by the Head Masters of certain public schools, which is now under the consideration of the Universities of Oxford and of Cambridge, and which has already been favourably reported on by the Committees to whom it was referred in either University.

"The scheme contemplates the establishment of a system of examination of boys, at the ages of about 16 and 18, in all the first-grade Schools of England, and of reports on the general efficiency of the teaching in each school, by Examiners sent from the Universities; the boys being allowed to select for their examination any five subjects, out of a specified list, subject to certain restrictions, which it is needless here to mention.

"We have observed with some regret that neither Physical nor Political Geography is as yet specified in that list; and we address you in the hope that the governing body of your University may see reason to repair the omission before the scheme is finally arranged; and we beg the favour of your bringing this letter to their notice in a suitable manner.

"We would invite your attention to the fact, that Geography has always been regarded as an essential, though subordinate, element of liberal education, having actually been taught, with more or less success, in all our great public schools. This fact was recognized in the Report of the Public School Commissioners, who, however, specially recommended a more effective and methodical study of this subject.

"We desire also to point out that Geography will become, very shortly, a large and clearly defined part of education in all the Endowed Schools of England; that is to say, in the very schools whose boys form the great majority of those affected by the proposed scheme of examination. This consideration is so important, that we submit to you the following extract from a letter received by us from the Secretary to the Commissioners of the Endowed Schools in answer to our inquiries:—

"'In reply to your letter, I beg to say, that in all schemes for secondary education the Endowed Schools Commissioners include Geography, usually specifying Physical and Political Geography, among the necessary subjects of instruction in all departments of the school. When a school is organized in two departments, some knowledge of Geography, among other subjects, is, as a rule, required as a qualification for admission into the Upper or Senior Department.'*

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* The letter of the Secretary to the Commissioners of the Endowed Schools is as follows:—

"Endowed Schools Commission, 2, Victoria-Street, S.W.,
"SIR, "19th June, 1871.

"In reply to your letter of the 15th instant, I beg to say that, in all schemes for Secondary Education, the Endowed Schools Commissioners include Geography—usually specifying Physical and Political Geography—among the necessary subjects of instruction in all departments of the School.

"When a School is organized in two departments, some knowledge of geography, among other subjects, is, as a rule, required as a qualification for admission into the Upper or Senior Department. In the case of Endowments connected with Elementary Schools, the Commissioners, if they find it necessary to prescribe subjects of instruction at all, always name Geography as one of them; and in declaring Trusts for the application of the annual income of the Endowment, they give the Governing Body a discretion of applying it, among other ways, in the

"We also beg to remind you that Geography is one of the optional subjects in all examinations conducted by the Civil Service Commissioners, including those preparatory to entrance into the Army, which are now undertaken by that department.

"Geography is so intimately connected with studies already the subject of examination in the Universities of Oxford and Cambridge, that we feel assured they could not intend to exclude it from their list of optional subjects. The Elements of Political Geography are the groundwork of History, and Physical Geography exhibits the field of Natural Science. The most learned of Continental nations express this opinion by the character of their examinations: thus, in the higher forms of the Prussian 'Gymnasia,'—whose system seems to have furnished, in some degree, the model of the scheme now before the Universities,—the pupils have to give one-tenth of their time to Geography, and have to pass a compulsory, not an optional, examination in it before they are allowed a certificate of fitness to enter a University.—(*School Inquiry Commission*, I. p. 68.)

"The growing importance of Geographical teaching is well shown by the subjects selected by candidates, who pass the examinations of the Science and Art Department of the Committee of Council on Education at South Kensington. There are no less than twenty-three subjects, in any of which candidates may offer themselves for examination. Now, it appears that, in the year 1866, one-ninth part of the papers thus set to candidates at their own option, were in Physical Geography; while in the present year, 1871, no less than one-quarter of the papers so asked for, out of a total of 38,000, were in that one subject. They were also more numerous than those on any other subject.

We would further point out the special importance of Geography to Englishmen in the present age. The possession of great and widely-scattered dependencies, the unprecedented extension of our commercial interests, the increased freedom of intercourse and closeness of connection established by means of the steam-ship and the telegraph, between our country and all parts of the world, the progress of emigration binding us by ties of blood-relationship to so many distant communities—all these are circumstances which vastly enhance the value of geographical knowledge. Great as its utility has always been, an acquaintance with the grand routes which commerce has followed, or is likely to follow — of the conditions under which civilization has succeeded or is likely to succeed—is far more useful now than it was in past times, when those traditions were established which influence the education of the present day.

"The use of Geography in different professions has been so often alluded to in detail, that it becomes hardly necessary for us to enlarge upon it here; but it is a subject on which we, as the executive body of the Royal Geographical Society, feel ourselves justified in expressing a general opinion, because we know that among the Fellows of our Society are many of the foremost men in every one of the careers by which the greatness and the varied national life of England are maintained. The association of such men in the pursuit of Geography is evidence of the importance of that science in the education of the most valuable classes of English gentlemen.

"We speak of Geography, not as a barren catalogue of names and facts, but as a science that ought to be taught in a liberal way, with abundant appliances of maps, models, and illustrations. We feel that we have earned a right to express an opinion, that Geography admits of being so taught and of being made the subject of scientific examination, by the experience we have gained,

provision of Maps or other aids to the teaching of Physical Geography. It must, of course, be left to the Governing Body and the Head Master, within their respective Departments, to decide in what manner instruction in Geography shall be given, and how far it shall be carried.

"I am, Sir, your obedient Servant,

"*F. Galton, Esq.*" "H. J. Roby."

through the establishment of certain Prizes by us for exceptionally good geographical attainments, among the boys of first-grade Schools. We find, as a matter of fact, that Geography is exceedingly well taught at some few large Schools, and that, unless it is very ill taught, it is everywhere apt to become a popular subject with both masters and boys. We also find that examinations in Geography are capable of testing much more than the memory: they give evidence of clearness of apprehension and of power of statement, of breadth of view, and of style in composition. It may be worth mentioning that, having assigned extra marks for maps and sketches, though only so far as they are effective illustrations of what cannot otherwise be easily expressed, we have observed, in some cases, that this indirect encouragement to drawing has borne most satisfactory fruit.

"We look to the Universities, not only to rescue Geography from being badly taught in the schools of England, but to raise it to an even higher standard than it has yet attained. It appears to be directly within the powers given to them by the proposed Examination Scheme to do so. They can improve the quality of the examinations, they can report on efficient and inefficient teaching, and, in this way, steadily develop geographical science into the form most suitable for the education of boys. Then, in a school well furnished with appliances for geographical teaching, the mere elements, which all ought to know, would be learnt in early boyhood with trifling difficulty, while the more advanced knowledge which older boys would require, who elected Geography, either Physical or Political, as one of the subjects of their examination, would be obtained without waste of effort, and without burdening the memory with names to which no corresponding image existed in the mind. Geography so taught would appeal strongly to the imagination; it would be found to abound in instructive generalizations, and it would vastly increase the range of a schoolboy's interest and his materials for after reflection.

(Signed) "H. .C Rawlinson, *President.*

"*On behalf of the Council of the Royal Geographical Society.*"

A copy of the foregoing was transmitted to the Vice-Chancellors of the Universities of London, Edinburgh, Glasgow, Aberdeen, and St. Andrew's; to the Provost of Dublin University; to the Vice-Chancellor of the Queen's University, Dublin; to the very Rev. the Warden of Durham University; to the Principal of Owens College, Manchester, and to the President of the Birmingham and Midland Institute, Birmingham, accompanied by the following letter:—

"Sir, "15, Whitehall Place, London, July 12th, 1871.

"We have the honour to enclose a printed copy of a letter recently addressed by us to the Vice-Chancellors of the Universities of Oxford and Cambridge, urging that Geography should be included in the programme of certain examinations, whence its omission would, as it appears to us, be open to grave objection.

"We do so, feeling that Geography, as a subject of education, possesses higher and wider claims than are represented by that particular scheme, and desiring to secure for a science whose advancement we have so much at heart, a proper and definite position among the optional subjects embraced in University examinations.

"We especially invite your attention to the concluding paragraph of the enclosed letter. We need hardly assure you that we should attach great value to the co-operation of your University in the object there indicated, as well as to any suggestions which you may offer or transmit on its behalf, with a view to practical action.

(Signed) "H. C. Rawlinson, President.

"On behalf of the Council."

PROCEEDINGS

OF

THE ROYAL GEOGRAPHICAL SOCIETY.

[Issued August 14th, 1871.]

SESSION 1870-71.

Twelfth Meeting (Anniversary) 1 p.m., *May 22nd*, 1871.

Sir H. BARTLE FRERE, K.C.B., Vice-President, in the Chair.

Sir Bartle Frere, in taking the Chair, explained to the Meeting that he did so owing to the unavoidable absence, through illness, of their venerated President, Sir Roderick Murchison. He also read the following letter from Sir Roderick:—

"My dear Sir Bartle, "16, Belgrave Square, 21st May, 1871.

"As you have kindly consented to take the Chair at the morning Anniversary Meeting of the Geographers to-morrow, I will be still more obliged to you if you will kindly express to the Fellows, before my Address is read by Mr. Markham, how very sincerely I regret being unable to deliver it in person.

"So great is my devotion to the cause, and so deep is my regard for my excellent associates, who have, through a long series of years, treated me with their entire confidence, that, paralyzed as I am, I had a few weeks ago almost made up my mind to be carried into the room and placed in the Chair to take leave of them.

"But to this project my medical adviser entered the most energetic objection, saying that the exertion might bring on another seizure; and I was unwillingly obliged to succumb.

"Those who have only seen me in my chair or in my carriage, into which I am carried, can have no idea of my thoroughly helpless bodily condition, though, thank God, my mind has been preserved intact. As, however, many persons have read in the newspapers long ago that I was rapidly recovering, I wish you to impress upon my Associates the truth.

"Slowly, *but very slowly indeed*, I am recovering, and I live in the hope of being able during the next Session to do my duty as a Vice-President.

"I write these lines because I have received frequent letters from friends congratulating me erroneously on my recovery; and if such an impression pervades the body of our Society, my associates would, indeed, have due cause for surprise that I should not have made an effort to attend in person on this marked occasion.

"With a renewal of my thanks for taking the Chair to inaugurate, as I hope, the election of Sir Henry Rawlinson as my successor,

"I remain, my dear Sir Bartle,

"Yours, sincerely and obliged,

"Rod. I. Murchison."

The proceedings were continued by the Secretary (Mr. C. R. Markham) reading the clauses of the Regulations which relate to Anniversary Meetings, and also the Minutes of the Meeting of 1870.

John Arrowsmith, Esq., and J. R. Shaw, Esq., were then chosen as Scrutineers of the Ballot about to take place.

The names of the following gentlemen were read as having been elected this day Fellows of the Society:—Lieut. W. F. Butler, 69th Regiment; Stewart Douglas, Esq.; Henry Geo. Hollingworth, Esq.; Arthur Earle, Esq.; Elliott Marten, Esq. (Vice-Consul at Sarawak); Geo. Buckley Mathew, Esq.; Walter Powell, Esq., M.P.; Pandeli Ralli, Esq.; John Osborne Smetham, Esq.

The Report of the Council was then read by Mr. C. R. Markham. Its adoption was proposed by Dr. G. Webster, and seconded by J. Arrowsmith, Esq., and carried without dissentient voice.

The Chairman then delivered the Royal Medals. The Founder's Medal to Sir Roderick I. Murchison, Bart., in recognition of the eminent services he has rendered to Geography during his long connection with the Society, in the course of which he has been associated with every exploring expedition for the last thirty years, and has further stimulated and encouraged geographical research by his Presidential addresses, fifteen in number. The Patron's or Victoria Medal to A. Keith Johnston, LL.D., for his long-continued and successful services in advancing Geography, as proved by numerous publications of maps, and especially for his merit in carrying out his scheme of Physical Atlases, by which the varied phenomena of Physical Geography are displayed by means of Cartography.

Major-General Sir H. C. Rawlinson, K.C.B., received the Medal on behalf of Sir Roderick Murchison. The Patron's Medal was received by Dr. Johnston in person.

The Chairman then proceeded to the distribution of the Prize Medals to the successful competitors from the Public Schools. Previous to delivering the medals he called upon Francis Galton, Esq., to read to the Meeting the results of the examination of the year, and to introduce the prizemen for Physical Geography.

Mr. F. Galton stated that the results of the Geographical Prize examination in this, the third year of its institution, were not less satisfactory than those of the two previous years. He would mention, for the sake of those who were unacquainted with the undertaking, that upwards of forty of the great public schools were invited to name competitors, either in Physical or in Political Geography; and that examinations were conducted simultaneously in

these two subjects, by means of printed papers sent, with requisite precautions, from the offices of this Society. The first boy in either subject receives the gold, and the second boy the bronze medal. Our examiners were Dr. Carpenter, F.R.S., Registrar of the University of London, in Physical Geography, and Charles Pearson, Esq., Fellow of Oriel College, Oxford, and Lecturer in History in Trinity College, Cambridge, in Political Geography. Last year forty-three schools were invited, and ten of them named competitors, whose aggregate number was eighteen in Physical, and seven in Political Geography. The competition was as keen as in previous years, though the number of competitors is smaller; for, owing to the published remarks of our examiners, the head-masters very generally abstained, last year, from sending in the names of boys who had no chance of success. The medallists were well worthy of their honours; the Gold Medallist in Political Geography—Hogben—had done exceptionally good work. He was also glad to state that, as a matter of fact, the time spent by the previous Gold Medallists in their geographical pursuits, does not appear to have compromised their success in those purely scholastic studies which form the chief element of school and university education; because at least three, and, he believed, all four of them, had done well in those studies also: they had already gained open University scholarships and exhibitions, and had, therefore, achieved such successes as, at their years, it was open to them to obtain. The ten schools which had named competitors were:—King Edward's School, Birmingham; Clifton College; Dulwich College; Liverpool College; Liverpool Institute; City of London School; University School, Nottingham; Rossall School; Sherborne School; Uppingham School: all of them very large, well known, and important centres of education; but it continued to be a subject of regret, that the older and more famous foundations do not as yet name candidates for our prizes. The results of the examination were as follows:—

PHYSICAL GEOGRAPHY—(Examiner, Dr. W. B. CARPENTER, F.R.S., &c.):—*Gold Medal*, Daniel McAlister, Liverpool Institute; *Bronze Medal*, William Gershom Collingwood, Liverpool College. *Honourably Mentioned*:—Robert Alex. Lundie, Liverpool College, and William Napier Shaw, King Edward's School, Birmingham, equal; William Clark Hudson, Liverpool College; Frederic J. Beckley, King's School, Sherborne; Thomas Disney, Rossall School, and William Ernest Evill, Clifton College, equal; Horatio R. F. Brown, Clifton College, and Woodforde B. Ffooks, Clifton College, equal.

POLITICAL GEOGRAPHY—(Examiner, CHARLES H. PEARSON, M.A., Trinity College, Cambridge): — *Gold Medal*, George Hogben, University School, Nottingham; *Bronze Medal*, Richard Naylor Arkle, Liverpool College. *Honourably Mentioned*:—Fras. Monkhouse Sparks, Rossall School; J. B. Heath, Clifton College; Douglas Samuel Bontflower, Rossall School; Arthur Hassall, Uppingham School.

The Hon. G. C. BRODRICK, at the invitation of the Chairman, introduced the prizemen for Political Geography. In doing so he said that these prizes were instituted two years and a half ago, mainly with a view to promote geographical education in our great schools, but not without the hope that, among those who competed for them, there might here and there be awakened the ambition to become a geographical discoverer. It was manifestly premature to say how far the latter object was likely to be attained; but with regard to the former the Society had, on the whole, reason to be satisfied with the results. They had secured the services of able examiners, and in every case the successful candidates had produced really good work. On the other hand, it was a subject of regret that the competition had not been so wide as had been hoped, and particularly that the greatest and most ancient foundations had hitherto held aloof. It must, however, be remembered that the principal duty of the great schools was to prepare for the Universities, and for the public services, both civil and military, and, therefore the Society must mainly look to the effect of pressing their claims upon the examining bodies. If these became impressed with a sense of the importance of geographical knowledge, the schools would prepare their boys for success in the examinations they would have to undergo. It was encouraging to know that a thorough and methodical study of geography was expressly recommended by the Public School Commissioners to the great schools. On the other hand, considering the intimate connection of political geography with history, and of physical geography with the natural sciences, and considering, too, the great success of men like Dr. Keith Johnston in popularising physical and political geography, it was a little discouraging that, in spite of this recommendation, it should still be necessary to claim for geography a definite place in our higher education. Why, the Father of History was also the Father of Geography, and no man could master the works of Herodotus without acquiring an extensive and valuable knowledge of the geography of the old world. It was, however, far more essential to an Englishman of the present day to be acquainted

with those parts of the world which had been explored, than it was to an ancient Greek in the time of Herodotus. He, therefore, had entire faith in the soundness and ultimate success of the objects to promote which these prizes were instituted, and he believed that these examinations would have a very sensible effect in promoting among young Englishmen the study of a branch of knowledge so ancient, so progressive, so rich in historical and scientific interest, and so essential a part of education for the citizens of a nation whose commerce is spread over every sea, and whose language is spoken in every great city of the habitable world.

The Prize of 5*l.*, annually granted to the successful competitor in the Geographical Examinations conducted by the Society of Arts, was then presented; Mr. Critchett, chief of the Educational Department of the Society, attending on behalf of the prizeman, Mr. John Armstrong.

Having presented the medals, the Chairman said it was a matter of regret that some of the scholars from the older public schools had not yet come forward to challenge the lead which had been taken by schools connected with the great centres of commercial and manufacturing prosperity, the scholars of which he trusted would in some future time emulate the glories of the learned men of Genoa, and Tuscany, and Venice in the middle ages. He was glad, however, to believe that there was a prospect of the great old public schools coming forward to maintain in this respect the position which they had so long held in the study of the classics and mathematics. One of the great reasons which had hitherto deterred the directors of those institutions from preparing their pupils for the examination, was the fear that attention to geography, by widening the area of study, might somewhat weaken the attention which they wished devoted to the pure classics and mathematics. There was, however, little danger of this being the case, for the best of the medallists were what the masters aptly termed good scholars all round. It was not merely in the more advanced classics, such as Thucydides and Polybius, that geography was more than a handmaid to other literature, but in the very earliest lessons in classical learning there was much to be gained by not excluding the study of geography. He was quite sure that the youngest boys on the lowest forms would read their Cæsar, and their Herodotus, and their 'Anabasis,' and their Cicero's Orations and Epistles, with much greater zest if they had a good knowledge of geography. A movement of opinion was taking place among the masters of our

great public schools in favour of giving the smaller boys some such help in the rather dry study of grammar. During the late war a typical difference between the officers of the two armies was, that while the one set of officers always had their maps with them and knew how to use them, the other set of officers were too often not only destitute of maps but did not know to use them when they got them, and the phrase "He can understand a map," came at last to be synonymous with "He is a perfect officer." The time might come when it would be of use to every young Englishman in his own home to know what a map was, and how to use it.

Admiral Sir GEORGE BACK proposed the following alteration of the Regulations of the Society: That the last lines of Clause 3, Sect. i. Chap. V. be omitted, viz:—

"And no new regulation, nor alteration or repeal of any existing regulation, shall be made at such Meeting, unless unanimously proposed by the Council."

Sir H. C. RAWLINSON seconded the motion, which was put and carried.

The farewell Address of the retiring President, Sir Roderick Murchison, on the progress of geography, was then read by the Secretary, C. R. Markham, Esq.

At 3 P.M. the ballot was declared by the Scrutineers to have resulted in the unanimous election of the following officers for the year 1871-2, the names in italics being those of the new Members or those who change office:—*President: Major-General Sir Henry C. Rawlinson*, K.C.B. *Vice-Presidents:* Sir H. Bartle Frere, K.C.B., G.C.S.I.; Francis Galton, Esq., M.A., F.R.S.; *Sir Roderick Impey Murchison, Bart.*, K.C.B., F.R.S., &c.; *Admiral George H. Richards*, F.R.S. *Trustees:* Lord Houghton, F.R.S.; Sir Walter C. Trevelyan, Bart. *Secretaries:* Clements R. Markham, Esq., F.S.A.; R. H. Major, Esq., F.S.A. *Foreign Secretary: John Ball, Esq. Councillors:* Admiral Sir George Back, D.C.L., F.R.S.; Hon. George C. Brodrick; *Sir Fowell Buxton, Bart.*; Rear-Admiral R. Collinson, C.B.; *The Earl of Derby*; James Fergusson, Esq., F.R.S.; A. G. Findlay, Esq.; Lieut.-Colonel J. A. Grant, C.B., C.S.I.; Vice-Admiral Sir W. H. Hall, K.C.B., F.R.S.; Capt. Sir F. Leopold McClintock, R.N., F.R.S.; *K. R. Murchison, Esq.; Capt. Sherard Osborn*, R.N.; Sir Charles Nicholson, Bart., D.C.L.; John Rae, Esq., M.D.; Major-General C. P. Rigby, C.B.; Arthur J. E. Russell, Esq., M.P. S. W. Silver, Esq.; *Warington Smyth, Esq.*, F.R.S.; *B. C. Stephenson, Esq.; Major-General Sir A. Scott Waugh*, F.R.S.; Charles White, Esq., J.P. *Treasurer:* Reginald T. Cocks, Esq.

Thereupon Sir Bartle Frere vacated the Chair in favour of the President-elect, Major-General Sir H. C. Rawlinson, K.C.B., who addressed the Meeting in these words:—

"The result of the ballot having been declared, I now take my place for the first time as President of the Royal Geographical Society, and I confess that I do so with great pride at being called to so distinguished a post, but at the same time with some fear and trembling. I am painfully aware of the disadvantages under which I labour in replacing Sir Roderick Murchison. I have no pretension to that accurate scientific knowledge which he had at his fingers' ends, and of which we have had such a striking illustration in portions of the anniversary Address that have this day been read to us. My geographical knowledge is mainly of that rough and ready sort which can be acquired by pretty extensive personal travel in the East and by desultory study at home; and really if this knowledge were not to be supplemented by a superior class of knowledge and by the steady support of the Council by whom the President is surrounded, I should greatly fear to be found inadequate to the requirements of the position. But, in looking over the ballot list, I find that the new Council consists of such names, and it has been so strongly reinforced both as regards practical and scientific strength, that I do trust it will afford me that supplemental aid which is required for the due discharge of the duties of a President. On looking over the list, I find that a first-rate authority, the Hydrographer of the Admiralty, has been placed amongst our Vice-Presidents. That alone is a tower of strength to us. I find also that we have secured the services of Mr. Warington Smyth, who was a former President of the Geological Society, and who is a first-rate authority on all matters of physical science. I find also the name of Mr. Charles Stephenson, the Secretary of Lloyd's Committee, which brings us at once into direct relations with one of the largest geographical bodies in the kingdom. I also find the name of Sir Fowell Buxton, so well known for his connection with African civilization; and over and above there is the name of the Earl of Derby, who has promised to aid us with his great talents and his large official experience. With the co-operation of such Councillors, I do hope that I may be able so to conduct the affairs of this Society that they shall not derogate from the flourishing position in which I now find them. At any rate I can promise one thing, and that is, devotion and assiduity to my duties; and I would fain hope that I

might follow, at however long an interval, in those footprints which Sir Roderick Murchison has left upon the sands of time."

Captain FELIX JONES proposed a vote of thanks to the retiring Vice-Presidents, Councillors, Auditors, and Scrutineers, for their services during the past year.

Major SLADEN seconded the motion, which was agreed to unanimously.

PRESENTATION

OF THE

ROYAL AWARDS.

The CHAIRMAN (Sir Bartle Frere) in presenting the Founder's Medal to Sir Henry Rawlinson, on behalf of Sir Roderick I. Murchison, Bart., spoke as follows:—

"I am commissioned, Sir Henry Rawlinson, by the Council and Fellows of the Royal Geographical Society, to place in your hands for presentation to Sir Roderick Murchison, the Founder's Gold Medal. If there is any difficulty in expressing the feelings of the Society on the subject, it arises solely from the intimacy of the connection subsisting since the origin of the Society between Sir Roderick and the Institution of which he deserves the honour of a founder, and over whose destinies for forty years he has watched with more than parental solicitude; and he has at length placed the Royal Geographical Society among the foremost, the most active, the most popular, the most widely known of our scientific Societies.

"The history of Sir Roderick Murchison's connection with the Royal Geographical Society is, in fact, the history of the Society itself. His name is conspicuous among the small band of geographers, who, in 1830, formed themselves into a society for the purpose of promoting geographical science, and who were afterwards incorporated by Royal Charter. He was first placed on the Council in 1831, and was made Vice-President in 1836. He was first elected President in 1843, for the biennial term 1843-44, and repeatedly re-elected, in 1851-52 and 1857-58; and since 1862, he has, by general consent of the Society, been always re-elected, as though the Society had agreed to make him President for life: nor would the Society now have sought to find a successor for him, had not Sir Roderick himself felt that, after his late illness, he required more complete repose than was compatible with the constant and arduous duties devolving on the President of so large and so active a society. During the fifteen years of his tenure of the office of *President*, he has prepared and delivered fifteen Anniversary

Addresses; each of them affording a very complete history of the progress of geographical science and discovery during the past year.

"These treatises, however, represent but a portion of his original labours as a geographer. Of the Memoirs and separate papers which he has from time to time published in various forms, and which probably exceed 150 in number, a great proportion are either purely geographical, or have more or less connection with geography. At least forty, which may be so characterised, have been published separately, with his name as the sole or principal author.

"It is a consequence of a singular union of extensive scientific knowledge with extreme kindliness of disposition and courtesy of manner, that his aid and advice have always been freely sought by geographers and geographical students of all ages and conditions, and of every country. The most advanced master (if master there be of a science so far-reaching and comprehensive of all other sciences) felt that Sir Roderick might throw fresh light on what the philosopher already knew; the humblest student of geography soon found that Sir Roderick would gladly assist any one who sought to extend the field of geographical knowledge; and thus it came to pass that he has become the common referee of geographers and scientific travellers of our own and of all other countries.

"It is no exaggeration to say that, during the past thirty years, no geographical expedition of any consequence has been undertaken in our own, or, I believe I might say, in any other country, without some previous reference to him for advice and suggestion, often entailing laborious research and correspondence.

"Of his labours as a Geologist this is not the place to speak, except so far as they have a bearing upon geography. It is true that no man can be a great practical geographer without a more than superficial knowledge of geology; but Sir Roderick has gone far beyond what was needed as an auxiliary to his geographical pursuits, and has been distinguished among the foremost of those original explorers, thinkers, and writers, who have built up our present knowledge of geology.

"Since, at the suggestion, I believe, of Sir Humphry Davy, he first applied himself to science, soon after he retired from the army at the commencement of the great revolutionary war, he has been intimately associated with Phillips and Sedgwick, with Lyell and Buckland, and with all the great geologists of the last and present generation. It was about 1825 when he first began to be known as

a writer on geology, and by 1831 he had vindicated his title to be one of our leading geological authorities and President of the Geological Society. By 1838 he had established the existence of the Silurian system, as one of the great distinctive divisions of our English geology, and had extended his investigations to France and Italy, Norway, Sweden, and Russia. Between 1840 and 1845 he was engaged on a Geological Survey of Russia, after examining the eastern parts of Germany, Poland and the Carpathians; and so highly did the Government of Russia estimate the results of his inquiries, that he received the highest honours which it was in the power of the Emperor to bestow on a foreigner, in recognition of scientific services.

"Since then, his labours in establishing the Laurentian and Permian systems, and, in conjunction with Sedgwick, the Devonian system, have added, as it were, so many provinces to the domain of geology; and since his appointment, in 1845, as Director General of the Geological Survey, in succession to Delabeche, he has taken a leading part in that branch of Practical Geology which has done so much to bring the science to its present position.

"Of the wide and far-seeing generalisations which mark the true philosopher, we have a familiar instance in the fact that, as far back as 1844, when writing on the geological structure of Russia, and comparing the auriferous regions of the Ural with Australia, he expressed a confident opinion that gold must be found in the latter country. During the next four years he repeatedly pressed his opinions on this subject, both on practical miners and on the then Minister for Colonial Affairs, though it was not till three years later that an almost accidental discovery of gold in Australia proved how true had been the philosopher's induction. This digression into the field of another science will be justified to geographers by the fact that there is hardly one of Sir Roderick's larger works on geology which is not also of such high geographical value as to be almost essential to anyone who would write on the physical geography of the district which was the subject of his enquiries.

"A bare enumeration of the honours which have from time to time been conferred on him in recognition of his scientific labours would suffice to show how highly they have been esteemed both in his own country and by foreign nations.

"By his own sovereign he was knighted in 1846, made a K.C.B. in 1863, and a Baronet in 1866.

"By the Emperor of Russia he was made a Knight of the 2nd

Class of St. Anne, and subsequently a Grand Cross of the same order, and of that of St. Stanislaus, and a Member of the Imperial Academy of Sciences; and he has received from other European sovereigns similar honours, the last of which—the dignity of Grand Officer of the Order of the Crown of Italy—will be in the recent remembrance of the Society. But in the honours thus conferred on him, sovereigns have only confirmed the reiterated testimony of the leading men of science and scientific bodies in every part of the civilized world. In his own country, the great Universities have conferred on him the honours of D.C.L. and LL.D., and M.A. The Royal Society, the parent of all our scientific societies, many years since recognised his merits by making him F.R.S., and subsequently a Vice-President, and by granting him the Copley Gold Medal. From Edinburgh he received the Brisbane Gold Medal, and the honorary Membership of the Royal Society of Edinburgh: he is Vice-President of the Geological Society, Fellow of the Linnean Society, a Member of the Academies of St. Petersburg, Berlin, Copenhagen, Brussels, Stockholm, and Turin; a Corresponding Member of the French Institute; a Trustee of the British Museum, the Hunterian Museum, and of the British Association for the Advancement of Science, of which, as well as of our own Society, he was an original founder and has ever been an active promoter. He has received the Prix Cuvier from the French Institute, the Wollaston Medal, and other honours of the same kind, which it would be almost impossible to enumerate.

"There is one distinctive feature which we all love to recognise in our President, and to which, in his absence, I am sure you will pardon my alluding. Sir Roderick has been through life no recluse book-worm, shut up in the recesses of his own study. He has, indeed, devoted himself as eagerly to science as if scientific knowledge were his only possession and profession; but he has neglected no one social duty which was entailed on him by his position as an English gentleman of fortune, and a Scotch Laird of ample means.

"I will here mention to the Society that in a letter to Sir H. Rawlinson, which he has just placed in my hands, Sir Roderick begs him to say that, 'Among the acts of his Presidency he was proud in having been the first President who induced the Council to deviate from old practice, in decreeing Gold Medals to two most remarkable *women*. To Mrs. Somerville as the pre-eminent geographer and physicist, and to Lady Franklin for her heroic exertions in determining the real fate of her husband.' How much the Society owes

to the practical good sense which tempered all his proceedings as President, I need not remind you. The true geographer must have something of the poetical genius,—the power of creating and combining; and, like all who share such faculties, the geographer is apt to be of the *genus irritabile*. How much we are indebted to the genial nature, the unselfish love of seeing others distinguished and rewarded, which characterized our President, I need not tell those who have so long enjoyed the benefit of that harmony which has accompanied the flourishing progress of the Society while under Sir Roderick Murchison's guidance.

"These results were not accomplished without devoting, at the same time, more time and attention to the external unscientific world than any recluse philosopher could have afforded. I have always thought that there was something peculiarly English in this habit of making science a part of his everyday life, instead of a separate and exclusive profession; and in this, as well as in other respects, his career appears to me full of instruction and excellent example to that great body of educated English gentlemen, to whom the circumstances of our island life and the necessities of Foreign and Colonial Service, offer so many opportunities for advancing almost every branch of natural science.

"After devoting the nine best years of his early manhood to the military service of his country, he had every temptation to rest on his oars and enjoy life after the fashion of so many of our countrymen who have no special motive for work; but he resolutely carved out for himself a career of scientific labour in which he has steadily persevered through life, and he has now the satisfaction of seeing not only accomplished results, which alone would form a scientific reputation of the highest character, but, in the establishment of this Society, a living national institution which, we may hope, will for generations to come continue, as active an agency in the promotion of geographical science, as it has been while it was presided over by him who had watched and directed its course from its first foundation till now.

"I will now ask you, Sir Henry Rawlinson, to receive this Medal on Sir Roderick's behalf, and to express to him the unanimous feeling of pleasure with which the Royal Geographical Society has voted him this Medal, as the only mark which it is now in their power to bestow, of the Society's sense of his great services to every branch of geographical science."

Sir HENRY RAWLINSON replied as follows:—"I am proud of having

been selected on the present occasion to receive the Founder's Medal which has been awarded to Sir Roderick Murchison; proud, because I feel that the medal has never been more worthily bestowed; proud, as an old Medallist myself, to receive Sir Roderick into our brotherhood. You have so well described, Sir, the important services rendered by Sir Roderick to the cause of geography, and to this Society in particular, that I need not dwell upon the subject. It will be more appropriate to offer a few words of explanation as to how it has happened that this year's medal has been bestowed on Sir Roderick, since it must occur to the Fellows that our venerated President could have commanded such a distinction at any moment of his career as the natural reward of his geographical services. I venture to explain, then, that when Sir Roderick announced his intention to retire, owing to failing health, the first impulse of the Council was to propose some testimonial, that should hand his name down to future generations, in immediate connection with the Society over which he had so long and so ably presided. While we were deliberating, however, on the best means of carrying out this resolution, we ascertained that Sir Roderick, with a delicate and touching appreciation of the value of the Society's approbation, would prefer to any testimonial, however costly and elaborate, the simple medal which he had himself so often presented to others as the reward of merit. That Sir Roderick was amply entitled to such an award no one could for a moment doubt. Indeed, our medal may be considered to have acquired lustre from him, rather than to have conferred lustre upon him. At any rate, as an old Medallist myself, I confess to feeling an additional honour in belonging to a body which numbers Sir Roderick amongst its members, and I believe that feeling to be shared by the other Medallists whom I see around me. I will now read the letter which Sir Roderick has addressed to me in acknowledgment of the award of the medal:—

"'My dear Sir Henry,

"'In requesting you to receive for me the Founder's Gold Medal, which the Council has bestowed on me, in recognition of my long services, I beg you to assure my Associates that this proof of their good opinion has been the greatest possible comfort to me in my present illness. This award satisfies me that the efforts which I have made for many years to promote the best interests of the Royal Geographical Society, and to advance the cause of the science which we cultivate, have been more than amply recognised.

"'I have now only to hope that by the restoration of comparative good *health I may be able*, if only for a short period, to perform the duties of one

of your Vice-Presidents, and so continue, to the day of my death, to be as attached an associate as ever of those valued friends with whom I have passed so many happy days.'

"I think, Ladies and Gentlemen, I may venture to say that the hopes of restored health, to which Sir Roderick in this note so feelingly alludes, find a responsive echo in the breast of every individual in this great assembly. It would, indeed, be a glorious day for the Geographical Society if we could once more see Sir Roderick in the Presidential Chair, welcoming to his native land the illustrious Livingstone on his long-wished-for return from his adventurous travels. In conclusion, I take this opportunity of announcing to the Society, on behalf of the Council, that, as a further mark of our high regard for Sir Roderick, and in view to keeping his image ever before us, we have decided on obtaining the replica of a bust which has been lately executed by Mr. Weekes, R.A., and placing it in the hall of our new premises in Savile Row. As the cost will hardly exceed 100 guineas, and we are desirous of including as many as possible of Sir Roderick's friends and admirers in this offering of affectionate remembrance, we have decided to limit contributions to a guinea, and have prepared a subscription list accordingly, which now lies upon the table for signature."

The CHAIRMAN then proceeded to deliver the Victoria Medal to A. Keith Johnston, LL.D. :—

"The Patron's or Victoria Medal is presented to Mr. A. Keith Johnston for his distinguished services in the promotion of Physical Geography. An early predilection for the study of geography as a science, and a desire to accomplish something better than had yet been attempted in England, led him to give up the medical profession to which he had been trained, and to devote himself to geography as a profession. His first published maps appeared in 1830. They were the results of a walking excursion through the North of Scotland, and were issued in a traveller's guide-book.

"His first large work was the 'National Atlas,' in folio, the result of five years' labour. Most of the maps were projected and drawn, and nearly all the names written, with his own hand. This work went through many editions, and was considered the best of its time. The writings of Ritter, Humboldt, and Berghaus on Physical Geography, and a wish expressed by Humboldt to see an English Physical Atlas constructed on a scale sufficient to show the details of physical phenomena more clearly than is possible on

the scale of the German edition, determined Mr. Keith Johnston to devote his attention to physical geography.

"In 1842 he visited Germany, collecting materials, and arranging for correspondence with foreign geographers. On his return, he communicated to the Secretary of the Royal Geographical Society his plans for publishing a great English Physical Atlas. Physical Geography was at that time almost an unknown science in our English schools, so that this Atlas could not for some time prove a paying speculation; but Mr. Keith Johnston was convinced 'that a desire for such information will increase with the general diffusion of education,' and expressed to our then Secretary his willingness 'to make sacrifices in a cause to which he had long been so ardently devoted.'

"On the 21st November, 1842, the Secretary of our Society expressed 'the highest gratification' of the Council of the Royal Geographical Society at a resolve which must 'greatly contribute to the prosperity of a branch of science *totally neglected* in this country, though of the highest interest.' At first it was intended that the work should be in the main founded on the great work of Berghaus; but this intention was early abandoned, and the number of additions and improvements was from the first so great as to make Mr. Keith Johnston's Atlas essentially an original work, marking the great advances which the science of physical geography had made since the publication of the noble German Atlas.

"In May, 1845, Mr. Keith Johnston had a special interview with Humboldt in Paris on the subject of the 'Physical Atlas,' the original merits of which were explained by Karl Ritter at a meeting of the Geographical Society of Paris, in the same year, under the presidency of M. Jomard. They were again acknowledged by Ritter in his letter as President of the Geographical Society of Berlin, in forwarding the Society's Honorary Diploma. It was not until the second edition of this work was published, in 1856, that Mr. K. Johnston was able able to overcome the difficulties of publishing so expensive a work, on a branch of geography previously almost unknown among us.

"The two editions cost him 10 years of the best period of his life, a large sum in the purchase of expensive foreign books, and a vast amount of labour, including correspondence, not only with the geographers already mentioned, but with Von Buch, Quetelet, Maury, and every physicist, British and foreign, who could aid him with *advice or materials.*

"As a result, 2500 copies of the 'Atlas' were sold, and the study of physical geography at once took its place among the necessary branches of a liberal education.

"His services to geography were recognised by the unsolicited presentation of the Fellowship of the Royal Society of Edinburgh, and of Honorary and Corresponding Fellowships of the leading Geographical Societies of Europe, India, and America. In 1865 the University of Edinburgh conferred upon him the honorary degree of Doctor of Laws, the highest honour of the kind it was in their power to bestow.

"In 1850 he published the first edition of his great 'Dictionary of Geography,'—an entirely original work, which cost him three years of incessant labour. It has gone through ten editions of 1000 copies each.

"For the International Exhibition of 1851 he constructed the first physical globe of the earth ever drawn. For this a large medal was awarded. Since 1851 he has devoted a great portion of his time to popularize the study of physical and other geography by constructing and publishing for educational purposes four atlases of general, classical, physical, and astronomical geography, besides a small elementary atlas. Of these works, from five to thirty editions have been published, of 1000 copies each.

"His medical studies in early life led him to devote a vast amount of labour to a chart of the geographical distribution of health and disease, which was completed in 1852.

"For this work the Epidemiological Society of London elected him a corresponding member, the President of that Society remarking that 'it is no false praise to say that no scholar out of the domain of medicine has ever before contributed so valuable a document to medical literature, a paper so rich in research.'

"In 1855 Mr. Keith Johnston commenced the 'Royal Atlas of Modern Geography,' devoting to it the experience gained during the labours of a quarter of a century.

"This work was *carefully watched*, and *every sheet criticised* as it came out, by the late Prince Consort, who took a lively interest in the work.

"Of the value of Mr. Keith Johnston's large Library Maps it is unnecessary to remind this Society. Of late years, he has mainly devoted himself to the preparation of maps and hand-books for educational purposes, and to cheapening the results of his previous labours so as to place them within the reach of geographical scholars

of the humblest means. Of some of the lowest priced of these works as many as 30,000 copies have been sold as fast as they could be prepared; and the service thus done to education has been acknowledged by the unanimous testimony of the highest authorities on education, not only in this country, but in Canada, in the United States, in India, Australia, and New Zealand.

"It was well observed by our President, in writing to Mr. Keith Johnston in 1856, that he had well deserved the highest honours which could be bestowed for such services, for, said Sir Roderick, 'most unquestionably you have really introduced the study of physical geography to the youth of our country.'"

Mr. A. KEITH JOHNSTON replied:—

"Sir Bartle Frere, I beg to express to you, and through you, to the Council and Fellows of the Royal Geographical Society, my heartfelt and grateful thanks for the distinguished honour you have just conferred on me; an honour which would be great at any time, but the value of which is greatly enhanced, in my estimation, by its being conferred on this memorable day, when geographers from every point of the compass have met to do honour to our venerated and estimable chief, Sir Roderick Murchison. You have been pleased, Sir, to allude in very kind, but far too flattering terms, to the amount of work I have been enabled to produce during a lengthened and all but uninterrupted course of labour. It is now more than half a century since my attention was first attracted to geography for its own sake, when a student of the classics at the High School of Edinburgh; and it is considerably more than forty years since I adopted it as the profession and business of my life. At the commencement of my career, I had for exemplars or contemporaries, our own indefatigable Arrowsmith in London, Berghaus in Potsdam, Kiepert in Berlin, and latterly, Petermann at Gotha. You are well aware, Sir, that work in this field must, from the nature of the case, be severe and exhaustive, to an extent unknown to those who have not engaged in it. But to me geography has truly been its own reward. Every step in the progress of physical geography appeared to me like a new revelation of the power, wisdom, and goodness of God in creation, as revealed in the wonderful adaptation of plants, animals, and men to the several spheres they were destined to occupy on our beautiful globe. If any portion of my labour yields, in the retrospect, more satisfaction than another, it is that in which I have been enabled to do something for the introduction of

physical geography into this country; and it is a source of much gratification, that I have lived to see it being adopted in our colleges and schools. I hope the day is not far distant when, encouraged by the premiums offered by our Society, it will be considered an essential branch of an enlightened and liberal English education. It would be unjust and ungrateful if I were not to allude to the aid I have at all times received from the Royal Geographical Society. The very existence of such a body, with its lofty aims and aspirations, offered a great inducement to a young man entering on a geographical career; and every President, since the time I joined the Society, has kindly offered me encouragement and tendered advice. I need not say how specially this refers to my old and tried friend Sir Roderick Murchison. I shall treasure this beautiful medal as long as life lasts, and shall hand it down to my family as an evidence that, in this great Society at least, honest, conscientious, and persevering labour will never lose its reward."

ADDRESS

TO

THE ROYAL GEOGRAPHICAL SOCIETY.

Delivered at the Anniversary Meeting on the 22nd May, 1871.

By Sir Roderick Impey Murchison, Bart., K.C.B.,
President.

Gentlemen,

When I last addressed you, at the commencement of the present Session, I was then the medium of the expression of your thanks to the Managers of the Royal Institution, for their kind consideration, by which we had been enabled to hold our meetings in their Theatre.

Now, when, through a heavy stroke of illness, I have since been unable to be among you, I beg to congratulate you on the success which has attended the appeal which I made in your name to the Chancellor and Senate of the University of London, to permit us to hold our meetings in the Grand Hall of their magnificent new edifice; and I did so because our Council had already determined, to my entire satisfaction, that the offices and map-rooms of our Society should be established in Savile-Row, in the immediate neighbourhood of the London University.

Although I have been prevented from attending any meeting in the Great Hall in which you have been assembled during the present Session, I rejoice to learn that you are admirably located therein: whilst it is most satisfactory to know that, when our adjacent new edifice is completed, there will be in it a room not only large enough to receive all our maps and illustrations, but also to contain as many members as usually frequent our ordinary evening meetings, should we in future find it necessary to avail ourselves of it.

The total number of our Fellows is still on the increase, and now

amounts to nearly 2400; and the volume of our 'Journal' for the year, thanks to the energy and assiduity of our unrivalled Editor, Mr. Bates, is already in your hands.

OBITUARY.

In such a very numerous body as our own, the usual percentage of mortality must necessarily amount to a large number; in the past year no fewer than 57 of our Associates were lost to us by death. Out of the sad list I will, in the first instance, allude to some leading men whose deaths we have to deplore.

The EARL OF CLARENDON, K.G.—By the decease of Lord Clarendon, on the 27th June, 1870, our country has been deprived of one of her ablest and most enlightened statesmen, who, in addition to his arduous public duties, was always a zealous promoter of geographical science and a warm friend of our Society. Born in 1800, he entered the Diplomatic Service in 1820. In 1823 he was appointed a Commissioner of Excise, and in that capacity arranged the union of the English and Irish Excise Boards (in 1826-27). In 1831 he negotiated a commercial treaty with France; and in 1832, when he was Her Majesty's Representative in Spain, he mainly assisted in bringing about the Treaty of the Quadruple Alliance. In the above-mentioned capacities he was well known as the Honourable George Villiers; and by the death of his uncle, the Earl of Clarendon, he succeeded to the title in December, 1838. As such, he was appointed Lord Privy Seal in 1840, and later in the same year he became Chancellor of the Duchy of Lancaster. In 1846 he was appointed President of the Board of Trade, and in the same year became Lord-Lieutenant of Ireland, which country he governed during a very arduous period till 1853, when he became Secretary for Foreign Affairs,—an office in which he greatly distinguished himself, and in which he signed the Treaty of Paris in 1856.

Lord Clarendon was, throughout his career, a strong advocate for Free Trade; and it is well known that it was very much through his influence the Emperor Louis Napoleon was induced to apply that doctrine, for the first time, in the government of France.

In society and private life, Lord Clarendon was generally beloved, whilst his very engaging manners rendered him justly a great favourite among foreign diplomatists. On my own part, I am proud to say that he honoured me with his personal friendship; and it was at his country seat, "The Grove," that I had opportunities of admiring the fine qualities of his heart, as shown when

in intercourse with his affectionate and devoted children, admirably brought up, as they had been, by a most accomplished mother.

WILHELM VON HAIDINGER.—Of our late Foreign associate, Wilhelm Ritter von Haidinger, it may be truly said that no single person had in his own country done more to arouse a spirit of interest and study in the various provinces of Natural Science.

Born at Vienna in 1795, Haidinger, at an early age, devoted himself to scientific labours; and for a number of years succeeding 1812 gave a special direction to his inquiries by becoming the pupil and friend of Friedrich Mohs, the distinguished mineralogist, at Gratz and Freiberg. From the year 1822 to 1827, as a worker in mineralogy, he travelled over a great part of Europe; and resided for some time at Edinburgh, where he published, in the English language, a translation of the Treatise by Mohs, in three volumes, 8vo., besides communicating to various scientific Societies and periodicals a large number of papers on special subjects.

For some years after this, he lived at Elbogen in North Bohemia, where his two brothers were conducting a porcelain manufactory, and at which place his kind and instructive hospitality to travellers will not readily be forgotten, by those who had the good fortune to stray thither from Carlsbad or the Erzgebirge. Invited by the accomplished Bohemian nobleman Fürst von Lobkovitz, who was then Minister in the Department of Mint and Mines, Haidinger, in 1840, accepted the direction of a new Museum, initiated, under Mohs, at the Imperial Mint of Vienna, with the particular object of promoting a knowledge of the mineral resources of the country. Only a few years elapsed before he was able to place so conclusively before the Austrian Government the advantages of a geological survey, that he was commissioned to organise that important national work, which, in conjunction with its museum, he continued to superintend till October, 1866. The mental activity of this amiable man—unwearied, in spite of delicate health—led him to constant exertion in the spreading of associations for the cultivation of science; and to him is, in a great measure, due the foundation of the Imperial and Royal Geographical Society of Vienna, as well as other institutions in Hungary, in Moravia, and at Milan. He deserves, too, the credit of having been mainly instrumental in paving the way for the publication of a most interesting chapter in modern geography, viz., the results of the voyage of the Austrian frigate the *Novara*. Our Society enrolled him as one of its Honorary *Members in the* year 1856.

Haidinger enjoyed the satisfaction of seeing a new scientific life spring up around him, and of committing the direction of his establishments to the able hands of Franz von Hauer and others of his former pupils.

Occupied to the last in scientific research, especially in all that related to meteorites, Haidinger passed the last few years of his life in comparative retirement, in his country-house at Dornbach, near Vienna, where he died on the 19th of March last.

BARON CHARLES ALEXANDER VON HÜGEL, a distinguished Austrian nobleman, and one of our Honorary Corresponding Members, died at Brussels on the 2nd of June, 1870, in the seventy-sixth year of his age. He was an eminent traveller and geographer, and had earned solid reputation for his travels in North-western India, Kashmere, China, and Australia, in the years 1835-40, concerning which he published his 'Kaschmir und das Reich der Siek;' 'Das Kabul-Becken und die Gebirge zwischen dem Hindu Kosch und dem Sutlej;' and other works. A thoughtful observer, and well-grounded in various branches of science, these records of his long journeys were an important contribution to the stock of human knowledge, and will ever be consulted by all who are occupied in scientific investigations, and particularly in the various branches of Natural History. For this distinguished service we rewarded him with our Patron's Medal at our Anniversary Meeting in 1849. His principal work, under the title of 'Travels in Kashmir and the Punjab,' was translated into English by Major Jarvis, and published in 1845. After his travels he filled successively many important diplomatic posts, and at the time of his death was Austrian Minister at the Belgian Court. Personally, I was intimately acquainted with this most intelligent and agreeable man, whose reputation stood very high among Austrian politicians, Prince Metternich having been his constant friend and supporter.

LORD DE BLAQUIERE.—By the death of Lord de Blaquiere I have lost an old friend, who zealously joined the Society under my Presidency, and I am happy to record of him that he became one of my most active supporters in the defence of ex-Governor Eyre.

Among other private friends who also joined the Society under my Presidency, I may enumerate Colonel SOTHEBY, son of the eminent poet, who had been for many years a constant attendant at our meetings; and SIR GEORGE PHILIP LEE, a most accomplished gentleman and a distinguished musician.

SIR ROBERT G. COLQUHOUN, K.C.B.—This excellent man was long

known as Consul-General in Egypt, in which capacity he was of signal service in promoting the cause of geography. He actively assisted in the succour of our distinguished countrymen, Speke and Grant, on their emerging from the heart of South Africa. He was also a warm friend of Sir Samuel and Lady Baker. On his return from his consular services he was created a K.C.B., and shortly afterwards married, as his second wife, Anne, only daughter of W. Cattrow, Esq. He died, at his paternal seat of Carnstraden, Dumbartonshire, on the 10th of December of last year. Sir Robert G. Colquhoun was very highly esteemed by all the chiefs of the Foreign Office under whom he served, and also by a very numerous circle of friends.

SIR JAMES CLARK, Bart., K.C.B., M.D., F.R.S., &c.—Few men of this age have been more beloved and respected than this eminent physician, who, through his intimacy with the Queen and Royal Family, lost no opportunity by which he could advance science. He was a distinguished chemist, and had the great merit of establishing the Royal College of Chemistry, under the auspices of His Royal Highness Prince Albert. It was through his advice that the Queen fixed upon Balmoral as her Scottish summer residence ; and so esteemed was he by Her Majesty that she assigned to him during his life the Royal demesne of Bagshot Park, where he died on the 29th June, 1870, in his eighty-fourth year.

SIR WILLIAM THOMAS DENISON, K.C.B., one of the oldest members of our Society, was a man of remarkable energy, who, in addition to his scientific acquirements as an officer in the Royal Engineers, possessed great administrative abilities. He was the third son of the late Mr. John Denison, M.P., of Ossington Hall, Notts, and brother of the present Speaker of the House of Commons, and of the late Bishop of Salisbury. He was born on the 3rd of May, 1804, and entered the army in 1826, becoming a Colonel of his corps in 1860. He was best known, however, as Governor of one or other of our colonial possessions. His first appointment was to the Lieutenant-Governorship of Van Diemen's Land, in June, 1846, when he received the honour of knighthood. Subsequently he became Governor of New South Wales, and in 1860 received the important appointment of Governor of Madras, which post he occupied until 1866. During this time he was temporarily Governor-General of India in the interval between the death of the Earl of Elgin and the arrival of Sir John Lawrence in January, 1864. He died on the 19th of January last. On my own part, I deeply regret the death of

this most active and intelligent public servant, who was a geologist as well as a geographer. For, whether as Governor in Australia or at Madras, he never failed to make me acquainted with the Natural History features of those countries.

Major-General Sir Justin Sheil, whose death occurred, after a short illness, on the 13th of April last, had distinguished himself in the military and diplomatic services of our Indian Empire. He entered the Bengal Native Infantry in 1820, and received the medal and clasp for the siege of Bhurtpoor. In 1833 he was sent to Persia as second in command of a detachment of officers and sergeants employed to discipline the Shah's army. His service in Persia on this occasion had important results on his subsequent successful career. In 1844 he was appointed Envoy and Minister at the Court of the Shah, which post he held till October, 1854; and in 1848 he received permission to accept and wear the 1st class Order of the Lion and Sun, conferred upon him by the Shah. He was made K.C.B. in 1855, after representing British interests at the Persian Court to the great satisfaction both of his own Government and that of the Shah. Sir Justin was brother of the well-known Right Hon. Richard Lalor Sheil, Member for Dungarvan. In 1856, his accomplished and amiable wife published an account of her Persian experiences, under the title of 'Glimpses of Life and Manners in Persia.' Sir Justin became a Fellow of our Society in 1857, and served as a Member of our Council in 1861. He was a frequent attendant at our evening meetings, and was often to be seen in the Library of the Society, making use of the treasures of Geographical literature there stored for the use of the Fellows. He was one of those supporters whose loss I much deplore.

Captain Burgoyne, R.N.—The Society, as well as the Royal Navy, have to mourn the loss of a gallant member in Captain Hugh Burgoyne, who perished with a number of officers, the *élite* of their profession, and five hundred brave seamen, in H.M.S. *Captain*, on the night of the 6th September, 1870, in the Bay of Biscay.

Captain Burgoyne was the only son of that eminent soldier, Field-Marshal Sir John Burgoyne, G.C.B. Although only thirty-seven years of age, he had served since 1847 in the Navy, and in those twenty-three years had earned a repute which gave high promise of a brilliant career. Brought up in his profession by some of its best officers, he was second to none of our captains as a thorough practical seaman, with a varied experience in every quarter of the globe. He was one of the few officers in the Royal

Navy, during the Crimean War, who had an opportunity of winning the Victoria Cross for gallantry in the Sea of Azov. His marked intelligence and freedom from professional prejudice induced the late Captain Cowper Coles, the inventor of the turret principle, to select him as the officer best qualified to test the great, but fatal, experiment put to the proof by H.M.S. *Captain*.

His untimely fate, and that of his noble shipmates, was a sacrifice to the good of their profession and country, by calling the attention of the Admiralty to the lamentable want of stability in many ships of our ironclad fleet. Although our Society may mourn his loss, yet we and his profession may justly be proud of an officer who nobly perished in the execution of his duty.

I owe this brief sketch of the lamented Hugh Burgoyne to his dear and attached comrade Capt. Sherard Osborn. Much more detailed knowledge of the deceased will eventually appear when his illustrious father can be appealed to, to speak of the qualifications of his dearly beloved only son—for as yet the venerable Field-Marshal is scarcely able to realize the irreparable loss he has sustained.

Mr. MARTIN CROFTON MORRISON, one of the best Chinese scholars of the day, and who had availed himself of his knowledge of the language and manners of the people to collect, with great toil and at much cost and risk, a mass of information relating to the north-eastern provinces of China, was the third son of the Rev. Dr. Morrison, author of the first Chinese and English Dictionary, and translator into Chinese of the Bible, Prayer-Book, and many other works. His mother was the eldest daughter of an Irish gentleman, Martin Crofton Armstrong, of Mohil House, county Leitrim.

Mr. Morrison was born on the 4th July, 1827, and received his general education under private tutors. For a couple of years he studied Chinese with Professor Kidd at University College, London. In 1843, having been appointed to the Chinese establishment by the Government of Lord Aberdeen, he left England to join his elder brother, who, with Sir Henry Pottinger, negotiated the Treaty of Nankin, and who was, at that time, Member of Council and Chinese Secretary to the Government at Hong-Kong. Very soon after his arrival his brother died; and he was thus left, at the age of sixteen, without guide or protector. But, even as a boy, Mr. Morrison was remarkable for thorough conscientiousness and for tenacity of purpose; and he earned the *entire approval* of his chiefs by diligent study and exemplary

conduct. He served in the capacities of Assistant Chinese Secretary, Vice-Consul, and Consul at various ports, till ill-health compelled him to retire from the service in 1866. During that long period his explorations were mostly confined to the provinces northward of the River Yang-tsze-kiang. The chief subject of geographical interest which he witnessed and examined, long before the visit of Mr. Elias, recorded in our 'Journal,' was the extraordinary alteration in the course of the Hoang-ho, or Yellow River, which, at about 2000 miles from its mouth, was abruptly changed from the general direction of E.S.E. to N.E.—an angle of over 60°—and now runs through the province of Shan-tung and empties itself into the Gulf of Pechili, about 430 miles from its former mouth, reckoning along the coast. Another topic was the Chinese rebellion, which greatly impeded his progress and rendered travelling at times very dangerous. Although these two subjects have each their distinctive characters, yet it was Mr. Morrison's opinion that it was possible to trace where the rebellion helped to effect or accelerate the great physical change in the river.

By his premature death, in November last, Mr. Morrison was stopped in the work on which he had been engaged ever since his return home, namely, a map showing the different trade-routes between India and China, and in putting into available form the knowledge he had acquired of the geographical, geological, political, and commercial conditions of these districts; and it is to be feared that no one else is qualified fully to utilise the materials he has left behind him. According to the testimony of all who knew him, Crofton Morrison well succeeded in following the examples of the father and brother he revered; and as his modesty, perfect unselfishness, and genuine kindness of disposition gained him the affection, so did his abilities, love of justice, and blamelessness of life secure him the respect alike of Europeans and Chinese.

Captain C. D. CAMERON.—Captain Cameron, under the name of Consul Cameron, was well known to the public as the unlucky prisoner of King Theodore, and one of the causes of the costly but brilliant Abyssinian war. Previous to his appointment as British Consul at Massowah he was known chiefly as having served with distinction in the Kaffir War, and as having been a member of the staff of Sir W. Fenwick Williams, when that gallant officer was *engaged in organising* the defences of the Turks in Kurdistan and

Armenia, during the Crimean War. He was then given the local rank of captain in Turkey, and was placed by his chief in superintendence of the fortifications which were being erected in Erzerum. After the war he served as Vice-Consul at Redout Kalé and at Poti, and was appointed Consul at Massowah in 1860, commencing his duties at that place in January, 1862. He became a member of our Society in 1858, but did not contribute to our Geographical publications in any way. He died on the 30th of May last.

THOMAS BRASSEY, M.P., the successful Railway Contractor, had been a Fellow of our Society since the year 1860. By the surveys performed under his orders for the many railways he undertook to construct in the Colonies and in foreign countries, he may be said to have been a contributor to the common stock of Geographical knowledge. He was born in 1805 at Boughton, in Cheshire, and died on the 8th of December last, at St. Leonard's, whither he had resorted for the benefit of his health. As a writer in the 'Times,' to whom I am indebted for these details, observes, a fair idea of the magnitude of Mr. Brassey's operations may be gathered from the fact that in the thirteen years, from 1848 to 1861 inclusive, he made, either directly or in association with others, 2374 miles of railway, at a contract price of nearly twenty-eight millions of pounds sterling. While his activity, intelligence, and probity in carrying out these great enterprises secured for him, towards the end of his career, a colossal fortune, he was throughout life esteemed for his benevolence and generosity. Many of his foreign undertakings, especially the flying railway over Mont Cenis, proved, in a pecuniary point of view, disastrous speculations to him; but such was the large view he took of everything upon which he was engaged, and such his steadiness of purpose and integrity, that although ample cause was given him to get rid of such bargains through failure of periodical payments, he always insisted upon carrying out his engagements to the letter.

Among other deceased members, though not men of science, many have been noted in other walks of life. These are:—Sir Edmund Antrobus, the respected partner in the house of Coutts and Co., General Akrell, Rev. C. D. Brereton, Mr. James Barrett, Captain Thomas Birch, Mr. J. O. Balfour, Mr. H. Blackett, Mr. J. C. C. Bell, Mr. H. Blanchard, Mr. D. Chambers, Mr. C. H. Dickson, Mr. W. F. de Gex, Mr. J. W. Dover, Mr. F. A. Goodenough,

Admiral Robert Gordon, Mr. J. Gibson, Mr. J. A. Hessey, Mr. J. Henderson, Rev. Sir H. J. Ingilby, Mr. F. F. Jeyes, Mr. R. W. Kennard, Sir J. Kirkland, Mr. R. Low, Dr. J. L. Learmouth, Mr. J. Mackillop, Mr. J. McEwan, Mr. J. Phillips, Admiral M. Quin, Colonel G. W. Raikes, Mr. G. R. Smith, Mr. G. Smith, Mr. J. S. Smith, Mr. O. H. Smith, Colonel Sir A. C. Sterling, K.C.B., distinguished on the staff of Field-Marshal Lord Clyde, Mr. H. Thorold, Rev. W. H. Walker, Mr. A. E. Way, Mr. A. Walker, Sir H. E. Young, Lieut.-Colonel M. W. Gladdish, Mr. W. H. Blaaw, and Major-General F. H. Robe, C.B.

Admiralty Surveys.*

The following is a brief outline of the Hydrographical operations which have been carried out, under the Admiralty, on home and foreign coasts during the past year.

Upon the east coast of England, Staff-Captain Calver and his three assistants, in H.M.S. *Porcupine*, were engaged, during the early part of the season, at the head of the Lynn Deeps, in furtherance of a complete re-survey of that extensive estuary known as the Wash, wherein many important changes had occurred since it was examined by the late Captain Hewett, R.N., upwards of forty years since.

During the middle and latter part of the summer the *Porcupine* resumed her interesting occupation of the previous year in the scientific investigation of the deep sea. The objects proposed on this occasion were a survey, physical and zoological, of the Atlantic slope along the coasts of Spain and Portugal, of the Strait of Gibraltar, and along the shores of the Mediterranean as far as Malta. The results, so far as the examinations extended, were eminently satisfactory; many interesting observations were made on the temperatures at various depths, and much new light thrown on the systems of ocean circulation and the connexion between the currents of the Mediterranean and the Atlantic Ocean.

Some very valuable observations were especially made both of the surface and under-currents in the Strait of Gibraltar by Dr. Carpenter, aided by the practical skill and ready resource of Captain Calver, with the view of settling this important problem; but, over so wide a field of research, it is obvious that much

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* *Communicated* by Rear-Admiral G. H. Richards, F.R.S., Hydrographer.

must still remain to be done before any fixed and satisfactory laws can be laid down and finally recognised; and for this we must hope for future investigations. It may be mentioned, in connexion with submarine currents in this region, that the Falmouth and Gibraltar cable, which was laid in June, 1870, and which failed to work a few months since, was found, when recovered, to have been chafed, in several places, as fine as a knife-edge, which, by those engaged in its recovery, is attributed to the action of a considerable current over a rocky, uneven bottom: this opinion, however, is as yet by no means clearly demonstrated. The fracture in the cable occurred in a depth of 500 fathoms of water, 100 miles westward of the Strait of Gibraltar, and about 60 miles south of the River Guadiana, where the surface current is not considerable.

For a full and scientific account of these researches, the reader is referred to the narrative drawn up by Dr. Carpenter and Mr. Gwyn Jeffreys, published in the 'Proceedings of the Royal Society,' No. 125, Vol. xix.

H.M.S. *Lightning*, under Staff-Commander John Richards, whose services are devoted to the western shores of England and the coasts of Ireland, was specially diverted from this service, during the early part of 1870, for the purpose of minutely surveying a section of the Strait of Dover, between the South Foreland and Cape Grisnez, with a view to possible engineering operations. The survey was carried out by running continuous lines of soundings from the neighbourhood of the Foreland to within 3 miles of the French coast.

Along the three central lines of this section soundings were obtained about 400 feet apart, the bottom being probed at each cast (by a machine, constructed for the purpose, weighing 7 cwts.) to an average depth of 8 inches, and specimens of the soil brought up. It may be interesting to state further that, on the oozy bank off Dover, the probing machine penetrated to a depth of nearly 5 feet, while in the offing 14 inches was the greatest depth reached, of which 6 inches consisted of drifting substances, such as gravel, sand, stones, &c., overlying 8 inches of chalk, the upper part of the latter, generally soft, hardening with the descent. Numerous fine specimens of chalk, of various colours, were obtained. But frequently the machine would not penetrate at all, and in some cases, where the attempts were repeated, the lower part of the probe was repeatedly broken and destroyed by contact with the hard bottom. *The substrata* of bottom of the Channel from the Foreland across

to near Cape Grisnez was found to consist entirely of chalk, but varying much in density as well as in colour; white and grey prevailing near the Foreland and in mid-channel, and brown as Cape Grisnez was approached. Veins of soft chalk, resembling pipeclay and varying in colour according to situation, were occasionally met with; but the general character of the ground was hard and very uneven, especially from mid-channel towards the French coast, where the great strength of the tidal stream appeared to have swept away drifting substances, and even to have hollowed out the soft veins of chalk, leaving only the hard ridges between.

The result of this survey seems to prove, from the unevenness of the ground and the strength of the current, unfavourable to a scheme which has been proposed of connecting this country with France by an iron tubular subway, though not unfavourable to a tunnel.

During the latter part of the season the *Lightning*, under Staff-Commanders Richards and W. B. Calver, was occupied in making a new survey of the estuary of the River Dee and its approaches, which were found to have much changed since the survey of 1859.

The Survey of Portsmouth and its neighbourhood has been conducted by Staff-Commander D. Hall, with a steam launch and a small party. During the past season a minute measurement has been made of the depths on the Bar of Portsmouth Harbour, an operation which it is highly necessary to make periodically, in order that timely measures may be taken to maintain the channel at a depth of 20 feet, or nearly so, at low water.

These successive examinations have shown that the deepening of the entrance to our greatest Naval depôt, from 13 feet to 20 feet, which was effected by dredging between the years 1858 and 1863, has proved a great success: nevertheless, some further dredging operations are required, principally to carry out conditions not strictly fulfilled on the occasions referred to.

Now that the bed of the Channel appears to have attained a state of rest, it is most desirable that these operations should not be delayed.

Commander Hall has also resurveyed the Medina River on a large scale, with the view to deepening certain parts of the channel by dredging; and plans on 30 inches to a mile have been constructed of the upper portions of Portsmouth and Langston harbours, showing the connecting channel facing Hilsea lines which has been excavated for the passage of gunboats.

Tidal diagrams have also been constructed, with the view of

showing the probable effect which would be produced on the bar of Portsmouth by connecting the tidal waters of the two harbours.

Mediterranean and Red Sea.—Captain Nares and the officers of H.M.S. *Newport* have been employed during the last summer in prosecuting the survey of the coasts of Sicily and the coral-banks between it and the coast of Tunis; a suitable deep-water channel was descried south of the Skerki reef, through which the telegraph-cables connecting Gibraltar and Malta, and the latter with Bona, have been successfully laid.

In consequence of the increased traffic through the Red Sea since the construction of the Suez Canal, a resurvey of the Gulf of Suez became necessary, and the *Newport* was detached from the Mediterranean on this service in September, since which time the survey has been vigorously prosecuted in the face of many difficulties: considerable progress has already been made, and the ship is about to return, until the cool season again sets in, when she will be replaced by a vessel more suited to cope with the weather and the climate of the Red Sea.

In compliance with a request from the Indian Government that a resurvey should be made of the port of Aden, previous to the dredging operations about to be undertaken for increasing its capabilities, Navigating-Lieutenant Ellis was sent from England in October to carry out this service, which has been satisfactorily completed.

West Indies.—Navigating-Lieutenant George Stanley has succeeded Staff-Commander Parsons in the conduct of this survey, and has been employed during the past season, with one assistant, in extending the survey of Demerara, which was commenced in September, 1869.

The approaches to the Rivers Demerara and Essequibo, with the adjacent coast, having been completed, the surveyors have lately been employed in obtaining off-shore soundings on the extensive bank which fronts British Guyana, an operation of a very arduous and tedious character, in the small sailing-vessel at their disposal.

Newfoundland.—This survey is conducted by Staff-Commander J. H. Kerr, aided by two assistants, and is carried on during the summer season in a small hired steam vessel. A portion of the last season was devoted to sounding the eastern approach to Belle Isle Strait, when the limit of the 100-fathom edge of the bank was well defined, in the interest of the line of passenger-vessels which run between Liverpool and Quebec, and adopt this route during a part

of the year. The fogs which are so prevalent on this dangerous coast, and which, in addition to the presence of ice, enhance the difficulties of navigation, give an increased value to these soundings as a guide to the mariner: with the same view, depths have been obtained on the hitherto blank spaces in the charts of the Gulf of St. Lawrence. During the latter part of the season, the surveyor were engaged in defining and charting the numerous dangers in the neighbourhood of Bonavista Bay, on the eastern coast of Newfoundland.

In the depth of winter, Commander Kerr and his assistant aided in several attempts to recover the broken Atlantic cable, but, owing to a constant succession of storms, intense cold, and the prevalence of ice, their efforts were unsuccessful.

British Columbia.—Staff-Commander Pender and his two assistants have been employed during the past season in examining the rugged western seaboard of the islands which front the coast of British Columbia, northward of Vancouver Island; this service has been completed, as well as the inner and sheltered ship-channels of communication, as far as the northern boundary of the colony, in 54° 40′ N. lat. Additional soundings have also been obtained on the bar at the entrance of the Goletas Channel, at the north end of Vancouver Island, and resurveys, on a large scale, of Becher and Pedder bays, at the eastern end of St. Juan de Fuca Strait. This survey may now be considered complete, and sufficient to meet all the requirements of the navigator and the settler for many years to come, and the party have been consequently withdrawn.

Cape of Good Hope.—During the past year this survey, under the conduct of Navigating-Lieutenant Archdeacon, has made excellent progress: the coast has been completed from Lambert Bay, northward, to a few miles beyond the Orange River, a distance of about 250 miles, although, from the want of a vessel, it has not yet been possible to complete the soundings off it.

Great hopes were entertained that the entrance to the Orange River would have proved navigable, thus opening up a new and shorter route to the lately-discovered diamond fields: such hopes, however, were not realised, the entrance having been found obstructed by an extensive sandbar, and the river within, for several miles, a mass of sandbanks.

A survey, however, of Port Nolloth, about 50 miles to the southward, has been executed. It is a small, but very safe harbour for vessels of light draught, and is becoming of considerable importance

to the colony as a port of shipment for the copper-ore obtained from the mines which are situated about 90 miles from the coast. "Great credit," Mr. Archdeacon remarks, "is due to the Copper-mining Company for the energetic manner in which they are carrying out works for developing the mineral wealth of this otherwise unproductive tract of country: a steam tramway is in course of construction from the port to the mines, 40 miles of which were completed and in working order at the end of December."

This surveying party has undergone considerable hardships and privations, consequent on the scarcity and extreme saltness of the water, and the almost entire absence of inhabitants in the vicinity of the coast, where the country is little better than a barren sandy waste.

South Australia.—During the early months of 1870, Navigating-Lieutenant Howard and his assistant were employed in a small colonial schooner in sounding the neighbourhood of Tipara Reef in Spencer Gulf, and examining the Northern Coast of Kangaroo Island, between Point Marsden to Cape Borda, a distance of over 50 miles.

Subsequently the coast was surveyed from the mouth of the Murray River to Cape Jaffa, 40 miles south of Lacopede Bay. Mr. Howard remarks of this bay that, although quite open to the westward, it is remarkable as a perfectly smooth anchorage; the swell from the Southern Ocean being entirely broken up and dissipated by the time it reaches within a mile of the beach, in four fathoms of water, even in the most violent gales. This circumstance he attributes to the very gentle undulation of the bottom, and the consequent very gradual shoaling of the water from about 10 miles off-shore up to the beach.

Later in the season the coast line was completed from Cape Jaffa to Glenelg River, making altogether a distance of about 230 miles of coast examined during the year: the greater part of this, owing to the impossibility of effecting a landing from boats, was carried out by shore parties, and the off-shore soundings still remain to be completed: on this work the surveyors are at present employed.

Victoria, Australia.—Navigating-Lieutenant H. I. Stanley, aided by two assistants, has completed the line of coast known as the Ninety Mile Beach, Gipps' Land, and carried the survey eastward to Cape Everard, a point about 40 miles from Cape Howe, the eastern limit of the colony. The greater part of this stretch of coast is uninhabited; and, as a landing could not be effected with safety, it

became necessary to carry on the survey by walking parties, crossing the rivers on rafts constructed of drift timber. In this manner, and in the face of many difficulties and privations, among them the absence of fresh provisions, 120 miles of coast were surveyed in less than three months, and conspicuous beacons erected for fixing the positions of the soundings still to be obtained. In addition to the above, large-scale plans have been made of Port Fairy and Warrnambool Harbour.

The coast has been closely sounded, from Wilson Promontory to near Merriman Creek, on the Ninety Mile Beach, amounting in measurement to about 400 square miles. The total amount of coast surveyed by this party during the year has been 180 miles, the greater part of which was open and exposed.

New South Wales.—It was noticed in the last annual report that the seaboard of this colony, together with the off-shore soundings, had been completed; the charts of the whole coast have since been published, and reflect the highest credit on all the officers who have been engaged in this excellent survey. Navigating-Lieutenant Gowlland, who, in succession to Captain Sidney (the officer who commenced and conducted the survey for several years), has brought it to a close, has been retained for a time in the colony by permission of the Admiralty, for the purpose of completing the inner waters, and has lately finished the survey of Clarence River.

Queensland.—Staff-Commander Bedwell, who is in charge of this survey, has, with one assistant, in a small colonial vessel, carefully examined and surveyed the shores of the colony from the northern part of Hervey Bay almost to Port Curtis, a distance of about 140 miles; and this stretch of coast has been closely sounded to a distance of twenty-five miles off-shore.

Eastern Archipelago.—Under this designation are included the Sulu Sea and the channels among the Philippine Islands leading eastward into the Pacific Ocean—the passages southward into the Sea of Celebes, the Moluccas—and Banda and Arafura seas towards Australia. It must be acknowledged that the term is sufficiently comprehensive, and the information which we possess regarding it as a navigable region is at present extremely imperfect. Looking to the prospect of an extensive commercial intercourse springing up between China, Japan, and the Australian colonies by these routes, the work has scarcely been commenced too soon.

H.M.S. *Nassau*, under the command of Commander W. Chimmo, was fitted out last year, and left England in May to commence this

great work. The ship passed through the Suez Canal and Red Sea, making an examination there, of various sites proposed for light-houses; she then carried a line of deep-sea soundings, in depths varying from 2000 to 3000 fathoms, between Galle Harbour in Ceylon and Java Head at the entrance of Sunda Strait, and thence up the China Sea to Hong-Kong, for submarine-cable purposes, finally leaving Hong-Kong for the scene of her work early in December; by the last accounts she had commenced her labours in the Sulu Sea.

Japan.—Commander St. John and the officers of H.M.S. *Sylvia* have been principally employed during the past year in making surveys of the intricate portions of the Inland Sea of Japan, which were most urgently required. They have completed the passages on either side of the "Conqueror" Bank, from Cone Island on the east to Mutsu Sima on the west, a distance of about 20 miles; and when this very important part of the navigation of what is now rapidly becoming a great thoroughfare, is published, it cannot fail to be a great boon to the seamen of all nations, and the navigation of the Inland Sea, throughout its whole length, about 250 miles, will then be an operation of comparative ease and safety.

The ports of Matoya and Owasi, on the south coast of Nipon, have also been surveyed, and will prove valuable as harbours of refuge, for vessels caught in bad weather between the eastern entrance of the Inland Sea and the Gulf of Yedo.

Commander St. John has furnished some valuable observations on the great Japan Current, and on the Typhoons, which prevail in this region, and acknowledges the valuable assistance which has been rendered to him in these researches by the intelligent Commanders of the Peninsular and Oriental Company's ships, running between China and Yokohama. It is gratifying to relate, in connexion with this survey, the very great interest which has been manifested in the work by the Government of Japan: everywhere the greatest possible attention and civility have been extended to the surveying parties, and assistance in the way of guides, interpreters, &c., freely afforded.

At the request of their Government, some young Japanese officers were received on board the *Sylvia*, and instructed in the art of nautical surveying and the use of instruments; acquitting themselves very creditably. A small steam vessel has also been placed at the disposal of Commander St. John, for the purpose of co-operating in the survey; and it seems not improbable that at no distant

time the Japanese may take up the Nautical Survey of their own coasts, or at any rate materially contribute towards its completion.

In closing these brief notices of the progress of the Surveys of the Eastern Seas, which it has been the policy of this country to pursue ever since our commercial relations with China were seriously established subsequent to the war of 1841, it is impossible not to reflect on the vast benefits which accrue, in consequence, to the commercial interests of all nations, but especially to our own, and at an expense to the country of very little more than the ordinary annual cost of two of the smallest class of vessels of war.

Summary.—The usual Tide Tables, lists of Lights, Hydrographic Notices, and Warnings to Mariners, have been issued during the past year. Of Sailing Directions there have been published a volume for the West Coast of England, from Milford Haven to the Mull of Galloway; revisions of the Channel Pilot, relating to the North Coast of France and the Channel Islands, and also of the Persian Gulf Directory. New directions have likewise been prepared for the navigation of Magellan Strait and the northern channels; the result of the late survey.

Forty new charts have been engraved and published, and over one thousand added to or corrected. Among the former may be noticed, as of especial importance to navigators, a new series of the North and South Atlantic Oceans in four sheets, and of the Indian Ocean in two sheets, on scales coinciding with the Pacific series previously in circulation; an entirely new series for the Strait of Magellan, embracing from Cape Virgin, on the east, to Cape Pillar and the Gulf of Penas on the west and north: these latter charts, on good navigable scales, are principally the results of the labours of the late Admiralty Survey under Capt. Mayne, C.B.; they amount to seven sheets, exclusive of numerous separate plans of anchorages; and there is no reason now why the largest steamers, with the assistance of these charts and directions, should not avail themselves of the smooth-water route, and enter the Pacific from the Gulf of Penas in the latitude of 47° S.

Lastly, it must not be omitted to notice a new Magnetic Variation Chart of the World, just published from materials collected at the Admiralty since 1858, the date of the last chart of the kind. Owing to extended magnetic observations in various parts of the world, and to the changing character of the element which this chart represents, it is important that it should be renewed at certain intervals of years. The present publication, under the superintend-

ance of Staff-Captain F. J. Evans, has been compiled by Navigating-Lieut. Creak, of the Hydrographic Department.

The number of Admiralty Charts printed for the use of Her Majesty's ships and the public generally, during the last year, has been one hundred and fifty-three thousand.

NEW PUBLICATIONS.—*Colonel H. Yule's edition of 'Marco Polo.'*—Whilst these pages are passing through the press, I have received an early copy of a work—a new edition of 'Marco Polo'—which, by the profound erudition it displays on all topics relating to the mediæval geography of Central and Eastern Asia, merits prominent notice in an Address like the present. Colonel Yule, indeed, by his previous work, 'Cathay, and the Way Thither,' noticed in my Address of 1867,* had shown himself thoroughly competent for the great work which he has now, after many years' labour, brought to a conclusion.

The maps, 17 in number, with which the two handsome volumes —in addition to 90 pictorial engravings—are illustrated, give a geographical character to the book at the first glance. Six of these maps are devoted to the elucidation of the itineraries of Marco Polo, and one is intended to embody his own conception of the geography of his route, being constructed, as far as possible, on his own corrected data and expressions. Among the others is a Plan of modern Peking and its environs, overlaid by another showing the city as it stood about the year 1290, when described by Marco Polo under the name of Cambeluc; besides plans of Hangchow, the Traveller's "Great City of Kinsay," with its lake; the remains of the Great Mongol City of Sarai, on the Volga; and so forth. The pictorial illustrations, also, are well selected, and often convey vivid ideas of the places and subjects described by the mediæval Traveller. Such is the one representing the Paizah, or Honorary Golden Tablets of the Mongols, to which Marco Polo so often alludes; and such also is the restoration of the ancient city of Pagán, in Burma, the *Mien* of the quaint Venetian Traveller, as compiled from Colonel Yule's own sketches on the spot. The carefully-studied illustrations of the Mongol camps of the Middle Ages, of the Chinese fleets, and of the Mediterranean galleys of the same period, as well as the representations of the aborigines of Western China, after Chinese drawings, are all of

* 'Journal,' vol. 37, p. cxxxi.

the same instructive character. In short, the reader will derive no little aid, in enabling him to realise the full meaning of the mediæval Traveller's descriptions and narrative, from the copious illustrations which enrich this remarkable book.

With regard to the Editor's part in the work itself, it may be observed that the Preliminary Discourse on the Life and Book of Marco Polo introduces a variety of documents from the Venetian Archives, of which some, such as the great Traveller's will, have not been before published in England, and others are entirely new. Among the latter may be noted the record of a case before the Venetian Court of Requests, in which Marco Polo prosecutes an unfaithful agent, who had been entrusted by him with the sale of a parcel of musk, the first document known in which Marco appears as an actual trader. The different texts of the Traveller's book, their sources, mutual relations, and comparative value, are made the subject of a discussion, which is illustrated by Tables, showing the filiation of the different manuscripts, as deduced by Colonel Yule; and a list of the known MSS., amounting in number to 75. It may be added, as a striking proof of the amount of original research made by Colonel Yule, that this number exceeds by nearly 30 the fullest list hitherto compiled; and that 27 of the whole number have been actually examined by him.

A task such as the elucidation of the many obscure points in the narrative of Marco Polo could not, as the Editor modestly observes in his Preface, have been satisfactorily accomplished by the resources of any one person. The force of this remark will be evident, when it is considered that not only a knowledge of the written language, history, and archæology of China and other countries of Asia is absolutely necessary, but an acquaintance with various recondite branches of science, and personal acquaintance with the topography of portions of the vast countries over which Marco Polo's travels extended. The sagacity and industry of Colonel Yule have, however, served him well in seeking and obtaining valuable aid from many authorities on special subjects. Among many others to whom he acknowledges his indebtedness, may be named the Cavaliere Gulielmo Berchet, of Venice; Dr. William Lockhart, formerly Resident in Peking; one of our medallists of last year, Lieutenant Francis Garner; Major Montgomerie, of the Indian Trigonometrical Survey; the Rev. Dr. Caldwell, author of the 'Dravidian Comparative Grammar;' Mr. A. Wylie, of Shanghai, *the eminent Sinologist*; the Rev. H. A. Jaeschke, of the Moravian

Mission in British Tibet; Pundit Manphul, C.C.I., lately British Agent in Badakhshan; Colonel Lewis Pelly, H.M. Resident on the Persian Gulf; Professor Schiefner, of the Imperial Academy of St. Petersburg; Sir Arthur Phayre; Sir Bartle Frere; and Professor Vámbéry.

Among the new geographical elucidations contained in the work, some of which are, to the great convenience of the reader, pointed out in the Preface, are the following:—The explanation of the name *Gheluchelan*, applied by Polo to the Caspian (I. p. 55); a detailed discussion, with a map, of the route between Kerman and Hormuz; and the identification, for the first time (by the aid of Colonel Pelly), of the site of the older Hormuz, on the mainland (I. p. 104–108); the identification of Polo's *Cobinan* with the still-subsisting district of *Koh-Benán*, in northern Kerman (I. p. 117); the establishment, by the aid of Pundit Manphul, of the position and continued existence of Keshm, in Badakhshan, the *Casem* of Polo, a place which had disappeared from modern geography (I. p. 147); the identification, by the aid of Dr. Caldwell, of the site and ruins of the great port of *Cail*, in Tinnevelly (II. p. 307); and many others of similar interest and importance.

Italy.—A remarkable revival of interest in Geographical enterprise has of late been displayed in Italy, the birth-place of so many renowned travellers and discoverers. The Italian Geographical Society, to which I have alluded in former Addresses, as presided over by the energetic Chevalier Cristoforo Negri, now comprises no fewer than 1254 members, as I learn from the Anniversary Address of the President, delivered at Florence on the 30th of April last. This Address, occupying fifty-five pages of large octavo size, is a comprehensive review of the progress of Geographical science and discovery during the year, and shows how closely its learned author has followed the achievements of travellers and the records of Geographical research in all countries. It is apparent from Signor Negri's observations that he is anxious to secure the co-operation of all those distinguished Italians who are engaged in exploration, under foreign Governments, and the results of whose labours have hitherto been published in other languages than their own. By gathering these within the fold of the Society of their mother country, great results may in future be anticipated. Even at present, the *Bollettino* of the Society, issued in annual volumes, contains many valuable original memoirs and maps, which all geographers will do

well to consult. During the past year the Society has received the Reports of Nachtigal's Expedition to the Sultan of Bornou, to which an Italian gentleman, Signor Valperga, is attached. The expedition intended to return by the dangerous route of Waday, where the unfortunate Vogel was murdered.

Switzerland.—From our indefatigable Corresponding Member, M. J. M. Ziegler, of Winterthur, we have received the usual annual Report of the progress made in perfecting the topography, geology, and climatology of Switzerland. By this we learn that the Geodetical Board have continued their operations since the last Report, and that Professor Hirsch has announced that the determinations of longitude will be concluded during the present year. We also learn that the Federal Government, in addition to the superb maps of Switzerland they had previously given to the world—the work of the Federal Ordnance Survey—have issued a new set of contoured maps of portions of the country, namely, the environs of Berne and of Interlachen, on scales of 1 : 25,000 and 1 : 50,000. The Surveys of Switzerland, supported by the Federal Government, tend gradually to render the knowledge of the topography and physical geography of this diversified portion of Europe as complete as possible. Thus, a cadastral survey of all the 132 municipalities of the Canton of Soleure is now in course of execution, under the direction of M. H. Denzler, on a scale of 1 : 500 and 1 : 1000.

UNITED STATES.—The American Geographical and Statistical Society of New York, which is destined, no doubt, to play an important part in the promotion of Geographical science, numbered, in the early part of the present year, 540 members. At the annual meeting, on the 20th of February last, an interesting general report on the geographical work of the United States for the past ten years was read by Professor Gilman, under the form of the annual Address to the Society. In this comprehensive discourse the numerous Expeditions which have been organized to survey the vast Western Territories of the States were briefly passed in review. The scientific results of some of these, published with rare completeness and at liberal outlay by the United States Government, are well known in England; others, such as the publications of the Geological Survey of California, are much less known, although of the highest general and scientific interest. This Survey, chiefly under the direction of Whitney, has examined the range of the Sierra Nevada of California, measuring its lofty peaks

and mapping out on a large scale the many picturesque valleys lying along their flanks. We now learn that a map is nearly ready for publication, giving the results of these surveys, as far as regards the central part of the State, in which the highest peaks of the country are situated. But more than this, a series of elaborate volumes is in course of preparation (three of which are already issued), devoted to the Geology, Physical Geography, Botany, and Zoology of California. When we consider that the cost of all this is defrayed by the State Government, and voted by the State Congress, we cannot but admire the enlightened public spirit thus displayed by the citizens of the "Golden State;" and our admiration is increased on learning that some portions of the country, especially those picturesque tracts where groves of the gigantic cedars are still growing, have been reserved by the State, in perpetuity, as vast parks for the enjoyment of the people.

Besides the noble work just mentioned, there are enumerated in Professor Gilman's discourse, among recent operations, the official survey of the country adjacent to the 40th parallel, under Mr. Clarence King, which includes an accurate topographical examination of a belt adjacent to the Central Pacific Railroad, with researches in its geology, botany, and so forth; and the surveys, by different parties, viz., Parry and Englemann, Gilpin, and Whitney and Brewer, of the peaks and so-called parks of Colorado Territory, comprising the central part of the Rocky Mountain system. An account is given also of a party sent by the Harvard Mining School, by whom a survey has been made of the loftiest portion of Colorado, the results of which have not yet been published. It has now been established that the three highest peaks in United States territory are Mount Whitney in California, and Mounts Harvard and Yale in Colorado, none much exceeding 15,000 feet above the sea-level. Other surveys have been—that of Arizona, by Mr. J. T. Gardner, the Utah Boundary Survey, Major Williamson's measurement of the depression below the sea-surface of Death's Valley, in the southern part of the Great Basin, and particularly the remarkable examination of the Great Cañon of the Colorado River, made by Major Powell during a courageous journey through this stupendous chasm. The interest excited by these surveys is creating in the States a demand for a national topographical and trigonometrical survey, similar to those of many European countries, which assuredly will not be much longer delayed.

It is scarcely necessary in this place to point out the great im-

portance of these works to all engaged in geographical pursuits. The Cartographer, indeed, both in the United States and in Europe, will readily adopt the great mass of new information supplied by these surveys, and register them on new maps for public use; but the Physical Geographer should not be unmindful of the great addition to the illustrations of his science which these explorations in the western parts of North America are calculated to furnish, undertaken, as they have been, over a portion of the world in a high degree remarkable for the variety and singularity of its physical configuration.

INDIA.—A Memoir on the Indian Surveys, by Mr. Clements Markham, has been printed by order of the Secretary of State for India, which is intended to furnish a history of the scientific surveys from their first commencement. The narrative is supplied with numerous references, in order to enable an inquirer to follow up his researches on any special point, or on any particular branch of the subject. It is thus a work the perusal of which will give a comprehensive idea of the measures that have been taken in India for the advancement of geography and kindred sciences, while it is also intended to be permanently useful as a book of reference. The Memoir is divided into seventeen sections. The first gives a history of the marine surveys conducted by officers of the Indian Navy, and is an interesting record of operations which have added very largely to our geographical knowledge. I need only refer, in proof of this, to the numerous important papers in our 'Journals,' and in those of the Bombay Geographical Society, by officers of the Indian Navy; all of which are noticed in this section of Mr. Markham's Memoir. The first surveys on land were not commenced until Lord Clive had won the battle of Plassy; when that great geographer Major Rennell commenced his honourable career by mapping the districts of Bengal and Behar. The second Section of the Memoir contains an account of the route-surveys of Rennell and his coadjutors in various parts of India. In the commencement of the present century, the system of route-surveying was superseded by the more scientific trigonometrical method introduced by Colonel Lambton. The eight following Sections of the Memoir contain a narrative of the labours of Lambton, Everest, Waugh, Thuillier and Walker, and of the distinguished officers who have served under them. This ground is covered by the measurement of the great Indian arc of a meridian, commenced by

Lambton, and successfully completed by Everest; by the operations of the Great Trigonometrical Survey, and by the work of the Topographical and Revenue Surveys. Here we have a record of work conducted with great scientific knowledge, with marvellous skill and judgment, and with untiring zeal; through which results have been obtained that are unsurpassed, for magnitude and importance, in any other part of the world. Hitherto the history of these most interesting operations has been buried in official reports, which are not easily accessible; and a complete general view of them, in a convenient form, such as is supplied by these sections of Mr. Markham's Memoir, cannot fail to be welcome to all geographers. In his 12th Section, Mr. Markham gives some account of the method of supplying instruments for the use of the scientific surveys in India, and of the observatory established at Lambeth, under the direction of Colonel Strange, for testing and examining them.

The subsequent Sections of the Memoir review the operations of the scientific labourers in those other branches of inquiry, which are included under the head of Geography in its most comprehensive sense. The 13th Section gives a history of the Geological Survey of India, as well as some account of the earlier labours of zealous independent inquirers before a systematic survey was established. Then follows a section on Archæological Researches in India, containing a general view of the work of James Prinsep, Wilson, Cunningham, Fergusson, Meadows Taylor, Walter Elliot, and other eminent men who have laboured in this important field of inquiry. A perusal of the Archæological Section of the Memoir will furnish very striking evidence of the close connexion between geography and the investigations of the archæologist. The identification of sites of ancient cities, and a comparison of their present position with the positions described in ancient writings, supplies proofs of physical changes, especially as regards the courses of rivers. Indeed comparative geography, which is not the least important branch of our science, is wholly dependent on the labours of archæologists. The next Section gives a detailed account of the meteorological and tidal observations that have been undertaken, from time to time, in various parts of India; of the valuable contributions to our knowledge of Indian meteorology by Colonel Sykes, General Boileau, Dr. Buist, Mr. Allan Broun, and others, and of the systematic arrangements for meteorological registration which have recently been adopted by the Indian Government. *In his 16th Section*, Mr. Markham records the labours of astro-

nomers in India. First touching upon the ancient studies of Ulugh Beg, and the later observations of the renowned Jye Sing, a sketch is then given of the work accomplished by the English successors of those Oriental astronomers, at the Madras Observatory, under Goldingham, Taylor, Jacob, and Pogson; and at Trivanderum under Caldecott and Allan Broun.

The 17th Section is devoted to physical geography, and to an attempt to supply information respecting the efforts that have been made to form generalizations from the observations collected by surveyors and other inquirers. Mr. Markham here enumerates the opinions which have been formed by geographers respecting the physical structure of the great Himalayan mass, the views entertained with reference to the river-systems, and the accounts that have been published of the physical features of other parts of India. He also gives an account of the labours of botanists, and supplies references to works on forest conservancy, and other results of human action, which have so important a bearing on the physical changes of the earth's surface.

Mr. Markham devotes a final Section to a history of the utilization of the work of the surveyors, and of the preparation and publication of maps, from the time of Richard Hakluyt, the first cosmographer to the East India Company. He reviews the labours of Rennell, Dalrymple, Horsburgh, Aaron Arrowsmith, and John Walker; and gives information respecting the preparation of the Indian Atlas, of the charts of Indian seas, and of other maps and memoirs. Mr. Markham is now himself in charge of the Geographical Department of the India Office; and it is a source of great satisfaction to find that care is at last being bestowed on the priceless collection of geographical documents which have been inherited from the old East India Company. The importance of having a Department in England, in communication with the surveyors and other scientific inquirers in India, has long been felt; and it is certainly a cause for congratulation among geographers that an arrangement should have been made which, while ensuring the efficient transaction of business connected with the Indian surveys, will also have the effect of securing a more general diffusion of knowledge in England respecting the noble and zealous labours of our brother geographers in the East.

The operations of the Surveys in India, during the last season, 1869-70, show steady progress, and have resulted in the production of a large number of useful maps, and of considerable additions to

geographical knowledge. Mr. Markham's memoir will enable geographers to refer to the previous history of operations now in progress; and, in reviewing the work of the Indian Surveys during the last season, I will therefore take them in the same order as has been adopted in the sections of his memoir.

Indian Marine Surveys.—Since the abolition of the Indian Navy, in 1862, no fresh marine surveys have been undertaken. This is the more to be deplored, as a great deal of very important work remained unfinished, while the surveys of many parts of the Indian coasts urgently require periodical revision. Mr. Markham has recently brought this subject to the notice of the Secretary of State for India; and I am glad to learn, from a statement made by Mr. Grant Duff, in the House of Commons, that its consideration has been referred to our Associate, Governor-General the Earl of Mayo.

The Great Trigonometrical Survey.—This great work, under the superintendence of Colonel Walker, is now approaching completion. Five trigonometrical Series are still in hand. The Brahmaputra Series, on the 90th meridian, under Captain Thuillier, has been pushed forward 56 miles during the last season. It follows the course of the Jamoona branch of the Brahmaputra, passing through a flat country, much cut up by watercourses. The operations of the Burmah Series, under Mr. Rossenrode, were, unfortunately, brought to a sudden stop, owing to the financial panic of last year. The Beder Longitudinal Series is to connect the Great Arc with the Coast Series. It passes through a most difficult and pestiferous region, chiefly in the basin of the Godavery. The work was undertaken by Sir George Everest, when quite a young man, nearly fifty years ago; but he and his whole party were struck down by malignant fever, and they were obliged to abandon the attempt. The country has scarcely been visited since, and has never been mapped. It is densely wooded, and thirty-two hill-tops had to be cleared of forest for observing-stations. Mr. Shelverton, who was in charge of this Series, during the season of 1869-70, carried the triangulation over 70 miles, and extended the preliminary work for 170 miles further. But he, like Everest, was struck down by fever, with most of his party, and five of his men died. Having partially recovered, Mr. Shelverton nobly stuck to his work, with that devoted zeal which has ever distinguished the members of the Indian Surveys; and the melancholy news has now arrived that he has died at his post, a true martyr to science. He had been many years in the Survey, and had done much valuable

service, which has been fully acknowledged in the reports of his chiefs. He was an admirable surveyor, and a man of undaunted courage and zeal. His loss will be much felt. The Belaspur Series, on the meridian of 82°, has been commenced by Mr. Keelan, and was extended for 95 miles during the last season. The Bangalore Meridian Series is intended to cover the ground of Colonel Lambton's original work, from Cape Comorin to the Beder base, which, in consequence of improved instruments and the more accurate methods of modern times, now requires revision. The Series is divided into two Sections, under Lieut. Rogers and Major Branfill.

The topographical surveys, under the superintendence of Colonel Walker, include those of Kumaon and British Gurhwal, Kattiwar, and Guzerat. The first, directed by Major Montgomerie, shows a very large out-turn of work; while that officer's highly interesting report on the journey of the Mirza—the native whom he instructed and selected for the extensive journey over countries unvisited by Europeans since the days of Marco Polo and Benedict Goes—is fully noticed in my narrative of the progress of discovery in Central Asia. I must not omit, however, to mention here the work of Captain Carter, in fixing the positions of many peaks in the mountainous country north of Peshawur. The Kattiwar Survey, under the thoughtful and judicious supervision of Lieut. Trotter, has made good progress, and a large area on the western shore of the Gulf of Cambay is completed. The Survey of Guzerat, under Major Nasmyth, was commenced during the season of 1869-70.

Two astronomical parties, on the meridians of 75° and 78°, have been at work, under Captains Heaviside and Herschel. The former took sets of observations at five stations between the parallels of Indore and Poona; while the latter took sets of observations at two groups, consisting of three stations each,—one near Bangalore, and the other at Coimbatore. The results, at several stations of a group, serve to show whether there is any essential local deflection. Such was found in both groups. Lieut. Herschel used the zenith-sector, recently completed by Messrs. Troughton and Simms, from designs by Colonel Strange, on which he reports very favourably.

The levelling operations of the Survey, conducted by Mr. Lane, covered a circuit of 570 miles in Oude and the North-West Provinces, during the past season, and the discrepancy at closing only amounted to 0·14 of a foot.

In the season of 1868-69 Major Basevi completed his series of pendulum observations on the great meridional arc of India. In 1869-70 he took observations on points on the coast, in nearly the same latitudes as the pendulum stations inland. He selected positions far from mountain ranges, that the results might not be affected by such variations of gravity as are met with in the vicinity of high land. A series of observations was also taken on the Island of Minicoy; and Major Basevi intends to observe on the elevated plateaux of Ladak and Tibet, at Aden and in Egypt on his way home, and to bring the work to a close by a series taken at Greenwich. His observations of last season were calculated to throw some light on the relative variations of gravity at continental, coast, and ocean stations. The results show that gravity on the coast is greater than inland, and at ocean stations greater than on the coast.

At the computing office of the Great Trigonometrical Survey, Mr. Hennessey and Mr. Cole have re-determined the thermal expansion of the standard bar, by very careful and exact investigations, which entailed much labour. An accurate knowledge of the factor of expansion of the standard bar was the one thing wanting to permit the final reductions of the base lines, and these reductions have now been completed. Colonel Walker has thus been enabled to commence the publication of the final results of the Survey; and his first volume has just appeared. It contains a very interesting introductory account of the early operations of the Survey from 1800 to 1830, and the details of operations connected with the base lines and the standard of measurement. The whole work, consisting of some twenty volumes, will form a complete history of the Great Trigonometrical Survey of India.

The Revenue Surveys of India, divided into the Upper and Lower Circles, have been actively prosecuted; and 21,054 square miles have been surveyed during the season of 1869-70. The Upper Circle comprises two parties in the North-West Provinces, one in Oude, two in the Punjab, one in Sind, and four in the Central Provinces. The Peshawur Survey, embracing 2467 square miles, under Colonel Johnstone, was commenced in 1863. Much valuable work has been done beyond the frontier, and several errors have been discovered in the old maps, especially one in the course of the Cabul River. Colonel Johnstone made friends with the wild hill-tribes, a race of plunderers, like our own Borderers three centuries ago. One of the Afreedees chanced to see the Colonel's crest—*the winged spur*—and, on asking its meaning, he was told the well-

known Border story, which rejoiced his heart. Henceforth there was a fellow feeling for the Sahib whose Border ancestors had the same pursuits as the Afreedees. In Nemar, the maps of the surveyors were of great use to the railway engineers in their preliminary operations. They were saved the necessity of making surveys of their own, which expedited their work materially. The Lower Circle comprises surveying parties in Nowgong, Luckimpore, Hooghley, Cooch Behar, Hazareebagh, and Seebsaugor. The work of the Madras Revenue Survey is also progressing, and the village and district maps form the basis for the future construction of useful maps on smaller scales.

The Topographical Surveys of India are undertaken to furnish all the details required for good military maps, and for engineering and other administrative purposes, in Native States, or in the hilly and thinly-populated regions where elaborate field-surveys are unnecessary. India is too large and diversified to be dealt with by one system of survey only; and Colonel Thuillier, who has now been in charge of the Revenue and Topographical Surveys for upwards of a quarter of a century, has pushed forward two systems side by side, each admirably adapted for the special requirements of the region to which it is applied. During the season of 1869-70 seven topographical surveying parties have been at work in Gwalior and Central India, the Central Provinces, Chota Nagpore, Ganjam, Bundelcund, Rajpootana, and the Khasia and Garrow hills. All these regions were previously either unmapped or represented only by very old imperfect sketches. They are for the most part wild and extremely unhealthy, and labour is procured with much difficulty. The total work includes 16,315 square miles surveyed, and 13,218 of advanced skeleton triangulation; and much material has thus been furnished for several of the unfinished atlas sheets. In the Central Provinces, the party commanded by Mr. Girdlestone was at work in the loftiest and wildest parts of the Satpoora range, and in the malarious forests near the Wyngunga valley. The party had been employed for sixteen years in this wild region, and had mapped 26,580 square miles. Colonel Saxton's party was employed in finishing the Saora hills, within the Ganjam Agency, which are inhabited by tribes who had never before allowed strangers to enter their country. The party under Lieutenant Sale, in Chota Nagpore, explored the extremely interesting region which forms the water-parting between the valleys of the Sone and Nerbudda. Lieutenant Sale himself suffered from an attack of malarious fever. The survey

of the Khasia and Garrow hills, which had hitherto been conducted by our associate Major Godwin Austen, was, after his departure on leave, entrusted to Captain A. B. Melville, the news of whose melancholy death has just been received.

Colonel Thuillier is year by year increasing the usefulness of his office, by the issue of excellent compiled maps, and by the rapid preparation of maps of the recently surveyed districts. In the last year no less than 24,558 maps were issued to government officials and local agents from the Surveyor-General's Office at Calcutta. In the photographic branch Colonel Thuillier is ably and zealously assisted by Lieutenant Waterhouse, and 60,116 copies of photo-zincographed maps were struck off during the year. But the great achievement of the season has been the publication of two quarter sheets of the Indian Atlas. In 1868 it was resolved that this work should be completed in India; and Colonel Thuillier made the necessary arrangements, and took skilled engravers out to Calcutta with him, on his return early in 1869. Mr. Coard is the superintendent of the engravers. The sheets now published at Calcutta are No. 87 S.W., which includes Lucknow, and No. 125 S.E., being a part of Sylhet. They will lose nothing by comparison with the engraved sheets produced in England. Mr. Coard has also devoted much of his time to training native engravers; and the young apprentices have made rapid progress in writing, and even in the more difficult process of hill etching. The advantages of engraving the sheets on the spot, where there can be immediate reference to the surveyors themselves and to the original documents, are sufficiently evident; and we may look forward to very excellent results from the remaining sheets of the atlas being prepared and engraved under the able supervision of Colonel Thuillier himself.

The Geological Survey of India.—The intrepid geologists, who are doing such excellent service under the leadership of Dr. Oldham, have visited many wild unexplored regions in India, and their valuable memoirs and reports have added very largely to our geographical knowledge. During the season of 1869-70, Mr. H. B. Medlicott has revised the geological maps of the Jhansi and Sangor districts, Mr. Ball revised the maps of the Rajmehal hills, Mr. Hacket explored the Jubbulpore country, and Mr. Ormsby, after completing a revision of a large portion of the Bhaugalpore district, added one more to the long list of men of science who have fallen victims to the Indian climate. Mr. Mallet reported on the geological structure of Aden, with a view to determining whether the

principle of Artesian wells could be applied there with any prospect of success. In Madras, Mr. Foote has been engaged in geologically mapping the valley of the Upper Kistna, to determine, on the one side, the outline of the great Deccan trap-rocks, which have overflowed all the other formations, and, on the other, to fix the boundary of the immense area of fundamental gneissic rocks. Mr. Blanford, who did such good service in Abyssinia, has been engaged in examining the coal-fields of Bilashur and the Nerbudda valley, and a valuable lead-vein at Chicholi, near Raipur. Mr. Hughes has explored the great coal-field of the Wurda valley, and has shown much judgment and skill in selecting localities for boring, while Mr. Fedden was mapping the area covered by trap-rocks, to fix their boundaries in the vicinity of the coal-measures. The operations of these zealous geologists have been recorded in memoirs, which also contain so much important geographical information that they call for special notice here. I am glad to find, from Dr. Oldham's last Report, that materials are now complete for the publication of several final geological maps.

The Archæological Survey of India.—Systematic archæological investigations, under the supervision of General Cunningham, who only left England last December, will commence in the ensuing season; and all previous work of this kind is noticed in the section of Mr. Markham's memoir which is devoted to this subject. But I cannot omit a notice of General Cunningham's first volume of his 'Ancient Geography of India,'—a very important work, which embodies some of the results of his previous antiquarian researches. In this volume, General Cunningham follows the routes of Alexander the Great, and of the Chinese pilgrim Huen Thsang; identifying the sites of several important cities and sacred spots. These identifications illustrate the changes that have taken place in the courses of the Punjab rivers, and of the Indus, and the extraordinary alteration of the whole region between the Sutlej and the Jumna. The work is a most valuable contribution to our knowledge of the ancient geography of India, and shows the great importance of archæological investigations, in the study of the physical changes that have taken place on the earth's surface.

Meteorological and Tidal Observations in India.—Within the last three years, the Indian governments have established a more systematic method of meteorological registration, under the superintendence of special reporters. A regular series of careful observations has been taken at the Surveyor-General's Office at Calcutta,

and others at the Madras Observatory, and at Bombay, for a long course of years; and an order has existed for many years enjoining the registration of the thermometer and rain-gauge at civil stations and hospitals. But since 1867 all work of this kind has been placed under special reporters, whose duty it is to inspect the various stations, reduce the observations, and submit annual reports on the climatology of their provinces. Mr. Blanford is the meteorological reporter to the Bengal Government; and he has worked very zealously to establish numerous efficient stations, and to utilise the observations that are thus accumulated. Dr. Murray Thompson and Dr. Neil occupy the same positions in the North-West Provinces and the Punjab; and the observations in Madras are superintended by Mr. Pogson, the astronomer. In future years, we may fairly anticipate valuable results from the systematic labours of the meteorological reporters, which will throw light on questions connected with the monsoons, and other special features of Indian meteorology. Tidal observations have, notwithstanding the urgent representations of Dr. Whewell, been hitherto much neglected in India. But Mr. Parkes, the consulting engineer of the Kurrachee Harbour Works, has recently investigated the phenomena of Indian tides with ability and success, and has published useful tide-tables, based on good series of observations, both for Kurrachee and Bombay. It is to be hoped that similar observations will be made at other points on the coast of India.

I cannot conclude this brief review of the work of surveyors and other scientific observers in India, without noticing the greatly increased facilities for obtaining maps and other official publications connected with geography, which have resulted from the establishment of a Geographical Department at the India Office, so ably directed, as it is, by our senior Secretary, Mr. Clements Markham, who has brought together all the knowledge above mentioned. Formerly the sheets of the atlas were the only official maps that were accessible to the general public. Now all maps published by the Surveyor-General at Calcutta are supplied at once by the agents appointed by the India Office; while a very complete catalogue prepared by Mr. Trelawney Saunders, the Assistant Geographer, enables the engineer to see at a glance the extent of the country of which the maps are already on sale, with their size and scales. Mr. Saunders has also prepared, by order of the Under Secretary of State for India, two small but elaborate maps of the mountains and river-basins of India. In these maps the Himalaya

mountains, especially, are distinctly delineated in a new form, the great chain of peaks being represented as a culminating outer range, separated by a series of elevated valleys from an inner range, which form the water-parting between the basins of the Ganges and Sanpu. The relation of the Himalaya to the Karakorum mountains, the Gang-dis-ri, and the lofty plateau of Tibet, is also defined; and the Kuenlun is represented as the northern escarpment of the Tibetan plateau descending to the depressed plains of Gobi. In general, the orography of this little-known region of highlands has been so distinctly defined by Mr. Saunders, as to invite further critical attention to the subject.

ASIA.—*Central Asia.*—I announced to you at the opening of the Session the irreparable loss which the Society had sustained in the death of that enterprising and accomplished explorer, Mr. Hayward, who it was once hoped would have solved the great problem of Central Asian Geography by traversing the Pamír Plateau from the frontier of India to the Russian possessions on the Jaxartes. A very full and interesting account of all the circumstances connected with the foul murder of this promising traveller was contained in a letter, which was written to myself by the agent, Mr. Frederick Drew, who was sent to investigate the matter on the spot, and which has since been read at one of our evening meetings and published in the 'Proceedings' of the Society; and I am now enabled to state that further intelligence has been received by the Government of India, from an independent source, which confirms the main points of Mr. Drew's Report, and shows that in the country itself, and among the hillsmen acquainted with the details of the actual outrage, no suspicion is entertained of the complicity of the Cashmire Maharaja or his officers. There are some grounds, however, for believing that the murderer, Mir Wulee, of Yassín, did act at the instigation—or at any rate with the full consent—of the powerful Chitrál Chief, Aman-el-Moolk, whose jealousy was aroused by the intrusion of a European traveller into the mountains; and if any measures, therefore, of retribution are ultimately decided on, it is probable that Chitrál will be held equally responsible with Yassín. In the mean time the Maharaja of Cashmire has undertaken to erect a monument to Mr. Hayward's memory in the Gilghit Valley, and a suitable inscription has been sent out from England to be engraved upon the tomb. A few books and papers were recovered from Mr. *Hayward's effects*, and are expected shortly to arrive in England.

but it is not likely that they will contain any geographical information beyond that already presented to the Society, as Mr. Hayward had only proceeded two stages in advance of his former station at the head of the Yassín Valley when overtaken by the assassins whom Mir Wulee had sent upon his track. The present whereabouts of the murderer are not positively known, but it is believed that he has taken refuge with the famous Akhoond of Swát, at a short distance from our Peshawur frontier; and his identification, at any rate, is rendered easy by a limping gait, which is likely to be permanent, as he sustained a compound fracture of the leg from the kick of a horse during his recent wanderings, and the bone has never properly united.

But although our hopes of obtaining through Mr. Hayward's energy and skill a complete map of the hydrography of the Pamír lands have been thus disappointed, considerable progress has been made through other means in clearing up doubts regarding the physical features of that interesting region. One of Major Montgomerie's native explorers, who rejoices in the pseudonym of "the Mirza," and who has proved himself to be a worthy companion-traveller to the celebrated Pundits, has lately executed a very remarkable survey of the southern portion of the Pamír Plateau. Following in the footsteps of our early medallist, Lieutenant Wood, from the Afghan frontier to the junction of the two arms of the Upper Oxus at Kileh Penj—with some unimportant variations in the route along the river of Badakhshán—the Mirza succeeded, under the most trying circumstances, owing to the severity of the winter season, in tracing up the southern arm of the river to one of its sources in an alpine lake, named Pamír Kúl or Berket-i-Yassín; and having thence crossed the watershed into the river-system of Yarkand, he visited the little-known city of Tash-kurghán, and subsequently proceeded by an entirely new route to Yangi-Hissar and Kashgar. The Mirza cannot claim a complete priority of discovery in his delineation of the route from Kileh Penj to Tash-kurghán, for another native traveller, Mohammed Amín, had already followed the same track and published his itinerary in Mr. Davies's Report on the North-western boundary of India; and a similar route, indeed, had been supplied to Macartney when he attempted, sixty years ago, to map this region about the sources of the Oxus; but Major Montgomerie's *employé* has, at any rate, the credit of being the first explorer who has taken an astronomical observation at Tash-kurghán since the time of the Jesuits, or who has furnished

any trustworthy data of the geography of South-Eastern Pamír suited to the scientific requirements of the present day. The remarks, indeed, of Major Montgomerie on the line of watershed from Ladak to Kokan,—as well as on the physical features of those great mountain-chains which invariably exhibit their culminating peaks on transverse spurs in advance of the watershed, and on the correct determination of the longitudes of Kashgar and Yarkand, all of which are based upon materials supplied by the Mirza,—must be of the highest interest to Geographers, and merit the warmest acknowledgments of this Society. The Mirza's achievements are summarised by Major Montgomerie in the following pregnant sentences:—"This total route-survey extends to 2179 miles, about 350 miles of this ground being entirely new. The heights of 28 different points have been determined by boiling-point observations, and 48 observations for latitude have been taken at 14 of the principal stations on the route."

In my last Anniversary Address I informed you that Mr. Douglas Forsyth, accompanied by that observant and accomplished traveller Mr. Shaw, had proceeded on a mission from the Viceroy of India to the Court of the Atalik Ghazi at Kashgar. This mission, owing to accidental circumstances, has not perhaps achieved the full geographical results that might have been expected from it, but neither has it been infructuous. Although, indeed, owing to the Atalik Ghazi's absence on a warlike expedition against the Tunganis on his eastern frontier, Mr. Forsyth was unable to proceed beyond the city of Yarkand, yet, in that limited field of operations, he obtained valuable results from the labours of his subordinates. In the first place, by detaching a confidential agent from Cashmire to rejoin him, by a circuitous route, in the plains of Turkistan, he succeeded in obtaining a report of the road across the mountains, by the Darkote Pass, where Mr. Hayward was murdered, and from that point, through Tash-kurghán to Yarkand; while, on his return journey, he further utilized the services of Mr. Shaw, as I shall presently explain, in the exploration of a considerable portion of unsurveyed ground between the Karakorum and Kuenlun. Mr. Shaw is stated in Mr. Forsyth's Report to have used his instruments carefully and continuously throughout the route, and his register of observations, which has recently reached us, has proved of the greatest value in setting at rest the long contested question as to the longitude of Yarkand. Major Montgomerie, from a careful comparison of the Mirza's route with all previously existing

materials, had been led to assign to the city in question a longitude of 77° 30'; and this would have been accepted by geographers as a certain position had not Mr. Forsyth stated, apparently on Mr. Shaw's authority, that the true longitude was 76°. This alarming discrepancy of a degree and a half of longitude, which threatened to throw the whole map of Turkistan out of gear, has been now removed, by the calculation of Mr. Shaw's lunar observations by a computor at Greenwich,—a mean result of 77° being obtained for the position of the city of Yarkand.

The only extension of geographical discovery which has been announced to us, on the part of the Russians in Central Asia, since our last Anniversary Meeting, has resulted from Col. Abramoff's expedition of last summer to the sources of the Zarafshan. In this expedition, the Russian troops crossed, on four different occasions, the snowy mountains, a prolongation of the Thiān-shan, which intervene between the valleys of the Jaxartes and the river of Samarcand; and found the passes to be from 15,000 to 16,000 feet above the level of the sea. Colonel Abramoff also carefully examined the two parallel valleys of the Macha and Yagnān, which run down from the western face of Pamír, and supply the head-waters of the Zarafshan. He found the Macha River to issue from a glacier which entirely blocked up the defile, and was reported to be 35 miles in length—the head of the glacier extending indeed to the eastward of the longitude of Kokan; while the sources of the Yagnān (to which, however, he did not penetrate) were reported to reach almost to an equal distance.

From these discoveries, it follows that the sources of the Zarafshan will have to be transferred about 100 miles to the eastward of the Fàn Lake, where, in the maps recently published, the river has been held to take its rise. Colonel Abramoff further ascended the pass to the south of the Fàn Lake, and stood upon the watershed between the the Zarafshan and the Oxus, looking over the rugged country which is drained by the Hissar and Kafir-nihan streams flowing to the southward. On his return to Samarcand, operations in the Keshtub and Maghian valleys, which furnish tributaries running north to the Zarafshan, likewise enabled the Russian commander to gain a tolerable knowledge of these hitherto unvisited localities; and the exploration of the Samarcand district, together with the adjoining territory of Shahar-i-sabz, may thus be considered to be now pretty well accomplished.

I am informed by Sir Henry Rawlinson that the geography

of the upper valley of the Zarafshan, and particularly of the Fân Lake and the Macha defile, admits of ample illustration from the Memoirs of the Emperor Baber, who frequently traversed these regions during the troubles through which he struggled to power. Most of the names, indeed, which have been recently brought to light by the Russian surveys are to be found in Baber, though hitherto not recognisable, owing to the faulty readings of the Turki manuscripts. Sir Henry will give ample explanations on this subject in his 'Monograph on the Oxus,' which will be printed in the next volume of the Society's 'Journal.'

Finally, it will interest geographers to learn that the Topographical Department of the Russian Government have quite recently completed a new map of their province of Turkistan, which will naturally contain all the new data gathered by the expeditions I have mentioned. It is to include also Western Siberia, and I trust we may be furnished with a copy, by the courtesy of the Russian authorities, to whom we are indebted for similar donations on former occasions.

In continuation of the observations I have already made regarding the Expedition of Mr. Forsyth, it gives me the highest satisfaction to mention that I have very recently received a long and instructive letter from our distinguished associate Mr. R. B. Shaw, the companion of Mr. Forsyth, descriptive of his journey across the mountainous region southwards and eastwards of the Karakorum Pass, to explore which he was detached from the rest of the party on returning from Yarkand. The letter is accompanied by a sketch-map of the Upper Valley of the Shayok, showing the line of watershed of this part of Central Asia. Besides determining correctly, by astronomical observations, the position and altitude of many spots hitherto unvisited, Mr. Shaw has delighted me, as a geologist, above all, by stating that he has determined the dip and direction of all the strata in this hitherto unexplored region; and has even collected many fossil shells, which, when sent home, will enable us to affix a precise age to the different rocks he has examined. His description of the difficulties which he and his followers experienced in traversing the deep defiles which lead from the western limit of the Tibetan plateau, and the rugged country of snow-clad peaks, vertical precipices and chasms, which extends from that point to the westward, is, indeed, most striking; and I have no doubt that, when this communication and map are

printed, they will form one of the most interesting and important parts of the volumes of our Society. The western edge of the great plateau is here edged by a huge wall of limestone mountains, placed like the *revêtement* of some gigantic embankment; and to this, in the opinion of Mr. Shaw, is due the preservation of the level uplands from the excavating action of rain and snow. For the clouds which drift up the Shayok Valley towards this lofty limestone chain are arrested by that phalanx of mighty peaks, and expend all their powers on its gradual destruction. The difficulties experienced by Mr. Shaw, in endeavouring to descend towards the old Karakorum road, are a sufficient commentary on this view of the physical structure of the region; his party being baffled in their attempts to penetrate the narrow water-worn gorges, where the naked limbs of his coolies were lacerated by the broken ice of the torrents, over whose beds they were compelled to march. This portion of the journey has furnished a real addition to the geography of Central Asia, of which the interest is enhanced by the varied powers of observation of this accomplished traveller.

Manchuria.—I learn through our Associate, Mr. Delmar Morgan, that an Expedition last summer, through Manchuria, under the auspices of the Imperial Russian Geographical Society, has accomplished results considered highly satisfactory to the executive of that important Body. The Expedition was entrusted to the command of the Archimandrite Palladius, and started from Pekin on the 13th of April, 1870, traversing the whole of Manchuria from south to north, viâ Moukden, Kirin, Petuna, Tsitsihar, Mergen and Aigun; a remarkable journey of nearly a thousand miles through one of the least known parts of Asia. Steaming down the Amur, Palladius next ascended the Ussurí to Lake Khinka, and, crossing the portage, arrived at the Russian port of Vladivostok on the shores of the Pacific. Being an Archæologist and Ethnologist, as well as a Geographer, and well acquainted with the Chinese language, Palladius devoted much of his attention to the study of the native tribes of Manchuria, their language, and the architectural traces of ancient civilisation. He has opened up, therefore, a new line of investigation, relating to the original seats and migrations of the old tribes which have had so powerful an influence on Chinese development. Ethnologists, as well as Geographers, will do well to consult the detailed account of that Expedition, which will, doubtless, be published in the Bulletin of the Russian Geographical Society.

In the western part of Mongolia, also, I learn, through a letter of Baron Osten-Sacken to Mr. Bates, a remarkable journey has recently been performed by Dr. Radlof, who visited the town of Khobdo in that little-known region. The narrative of this journey is to form part of one of the volumes published by the Russian Geographical Society. Another journey in the same country is that of M. Pavlinof, who travelled over the previously unvisited route from Khobdo to Uliassutai, and passed from this latter town across the Tangnu Oola range towards Minussinsk, in Eastern Siberia. The result of this latter journey is the accurate measurement of altitudes in the Tangnu Oola Mountains, and the rectification of our maps regarding the hydrology of the Upper Irtish.

Burmah.—The Expedition conducted by Major Sladen, our Political Agent at the Court of Mandalay, overland towards the Chinese frontiers, although it has not yet produced those commercial results which were expected, added considerably to our geographical knowledge of that part of Asia. The Expedition, as is well known, was intended to ascertain the possibility of opening up a route for commerce between the well-peopled and wealthy south-western provinces of China and the British Port of Rangoon, thus saving the extremely circuitous route by sea and along the Yang-tsze-Kiang. Major Sladen ascended the Irawaddy to Bhamo, and then marched north-eastward towards Yunan, succeeding in reaching as far as the town of Momein in that province. Political, rather than physical obstacles, seem to lie in the way of a large traffic being established in this region, the whole of this part of Yunan being dominated by Mahomedan insurgents against the Chinese authority. The information gleaned by this important Expedition is, at present, limited to an official Report scarcely accessible to the public. It is desirable, therefore, that the able leader may be induced to communicate it in some more accessible form, either as a contribution to our Society or as an independent work. Dr. J. Anderson, the Naturalist attached to the Expedition, a memoir from whose pen on the Irawaddy appears in the new volume of our 'Journal,' brought home valuable collections of Natural History, besides an extensive series of drawings and photographs of the little-known wild tribes, and the magnificent scenery, of the Upper Irawaddy and the mountainous region beyond, and I believe I express the wishes of all men of science in this country in hoping that the Indian Government will grant some aid towards *this publication.*

CHINA.—*The Upper Yang-tsze Expedition of* 1869.—Since the opening of the Yang-tsze-Kiang to steam-navigation as far as Hankow in 1861, and the venturesome expedition of Captain Blakiston's party in the same year, the Upper Yang-tsze has attracted much attention from explorers as well as merchants, &c. In 1869, Sir R. Alcock, Her Majesty's Minister in China, despatched Mr. Consul Swinhoe to examine and report on the commercial capabilities of that part of the Great River, with a view to the impending revision of the Treaty of Tientsin. Mr. Swinhoe was wise enough to invite the Chamber of Commerce at Shanghai to send representatives to accompany him on his journey; and from the joint reports of the party we have obtained much valuable information, both as regards the geography and hydrography of the Upper Yang-tsze and the nature of the products and trade of the region. One of the delegates of the Shanghai Chamber was Mr. A. Michie, one of our associates, and well known as the contributor to our Journal (vol. xxxiii.) of a memoir on his former journey from Tientsin to Moukden in Manchuria. These gentlemen fully confirmed the reports of previous explorers as to the great wealth and population of the province of Szechuen. Mr. Swinhoe's party did not go further than the chief commercial city, Chungking, and consequently did not reach the fertile plains of Szechuen. Yet even the rugged country through which they passed is described as being remarkably rich, the soil being particularly adapted to the growth of opium, tobacco, wood-oil, &c., besides furnishing a fair proportion of ordinary cereal crops.

The party ascended in one of her Majesty's gunboats, under the orders of Admiral Sir Henry Keppel, K.C.B., to the town of Ichang, 360 miles higher up the Great River than Hankow, thus practically demonstrating the navigability of the river to that point. At Ichang, however, commences the long series of rapids, which extend for 100 miles to the town of Kwei-foo, and even beyond that point continue to be met with at intervals. Navigation of these rapids by foreign-built steamers is considered impossible for the present, though the native boats carry on a regular traffic on the river by means of towing and an enormous expenditure of manual force.

The examination of these rapids and obstructions by our naval surveyors of this Expedition may, indeed, be considered one of the most important geographical results of the mission. According to *Mr. L. S.* Dawson, the senior surveyor, there appears to be no hope

of steam-navigation being carried on through what is called the "Gorges of Ichang," that is, the series of reaches between Ichang and Kwei-foo, where the bed of the Great Yang-tsze is contracted between lofty precipices of rocks, and the channel beneath encumbered with huge boulders. The depth of the water in the gorges was found to be generally more than twenty fathoms, but in one gorge forty-four fathoms were obtained. So violent and uncertain are the currents which sweep from side to side among the rocks, that it was found almost impossible to follow out the survey in a boat, with ten rowers. Commander Stokes, of the gun-boat *Opossum*, states that the rise of water in the summer in these narrow straits was from sixty to eighty feet; and believes that it is due to the melting of the snow on the mountains between China and Tibet. In the rapids the velocity of the current was from eight to ten knots an hour.

How to bring the large and wealthy province of Szechuen into closer commercial relationship with this country is the interesting problem which the delegates of the Shanghai Chamber of Commerce set themselves to solve. Swift, safe, and easy communication is the obvious desideratum; but the mountainous nature of the country seems to preclude the means which would solve the matter in any other country, viz., railways, at least until the introduction of that admirable conveyance has been assented to by the Chinese Government, and has been tried in some more accessible part of the country, where fewer difficulties would have to be encountered. In the mean time the delegates recommend the extension of steam navigation as far as it can be rendered practicable, viz., to Ichang, a measure which would, it is anticipated, result in a considerable increase in the sale of British manufactured goods in that part of China.

An enterprising Prussian, the Baron von Richthofen, after doing good service to geological science in the United States of America, has, during the last two years, been actively engaged in China in investigating its geology and mineral productions. In 1870, under the auspices of the merchants of Shanghai, the Baron made the journey from Canton to Peking overland, *viâ* Hankow; and, though the matured results of this important survey will not see the light until the explorer has returned to Europe, and had time to prepare his materials, yet the preliminary Reports he has already published, from time to time, warrant the conclusion that his information will be of the most valuable practical kind. For a perusal of these

Reports, copies of which were forwarded to the Foreign Office, I am indebted to the courtesy of Lord Granville.

The various coal-fields in the province of Hoo-nan have been described by the Baron, and new light has been shed on the mineral wealth of that province generally. As Hoo-nan was known to be a large consumer of foreign goods, it was an object of interest to ascertain how far the principal river which drains the province through the Tungting Lake was navigable by steamers; this point Baron Richthofen settles unfavourably, with regard to the prospect of steam-navigation. Except in the brief and capricious season of floods, the Siang is only capable of floating boats of very light draught carrying a few tons of cargo. On the other hand, however, certain lines of traffic are shown to be well adapted for railways.

After traversing Hoo-peh, and describing minutely the resources of that province, and the capabilities of the River Ham, which falls into the Yang-tsze at Hankow, the Baron explored Honan and Shansi; and in the latter province he met with the richest reward of his labours, "one of the most remarkable coal and iron regions in the world." The Baron estimates the coal-field of Shansi to be considerably greater than that of Pennsylvania, and to be capable of supplying the whole world, at the present rate of consumption, for thousands of years to come. As an illustration of the thickness and extent of these carboniferous beds, he says that were a railway ever to be constructed in that region it would be tunnelled for miles through the coal-beds. These vast resources are not utilised owing to the unskilfulness of the natives in mining, and chiefly to the absence of roads. There being no available water communication, and the bridle-roads being indescribably bad, the coal and iron of Shansi cannot be profitably transported for more than a few miles. The Baron predicts a wonderful improvement in the condition of the people, and the stability of the government, when railways are permitted to connect these great mineral regions with the coast.

Herr von Richthofen has, in one of his Reports, remarked on the deterioration of the climate in Central and Northern China, the present condition of agriculture comparing unfavourably with that of former times, as described in the historical records. This deterioration he attributes to the destruction of the forests for fuel —and this on the very area of some of the richest and most easily worked coal-fields in the world!

This distinguished geological surveyor had in contemplation a

still more important journey, namely, from Peking, through Shensi Szechuen, Yunnan, and thence eastwards to Canton; but, when on the point of starting, the atrocious massacre of foreigners at Tientsin occurred, which revealing a powerful conspiracy against foreigners, the Baron wisely declined to trust himself in the interior so long as the people were exposed to such bad influences. It is to be remarked, however, that the Baron speaks in the highest terms of the friendly disposition of the Chinese people when left to themselves.

Whilst the geography and topography of China, as well as its present commercial condition, archæology, and so forth, are continually receiving new light by the researches of many of our talented countrymen and other Europeans in China, whose contributions are published in the 'Journal of the North China Branch of the Asiatic Society,' papers of value are occasionally communicated to our Society and attract much attention. Such, last Session, was the Memoir by Mr. Ney Elias on the 'New Course of the Yellow River,' which gave us for the first time accurate information regarding that remarkable phenomenon, the diversion, by spontaneous movement, of the waters of the great Hoang-Ho, or Yellow River of China, which occurred in 1851, but was not completed until 1853. The investigation of this subject was undertaken by Mr. Elias, one of our younger associates, through a pure love of geographical exploration, during the summer holidays taken from active commercial pursuits at Shanghai, and the manner in which he carried out his examination did him the highest credit. He traced the new course of the river down to its new embouchure in the Gulf of Pechili, and visited the spot where the river had broken away from its old bed by the rupture of its northern banks, fixing positions by astronomical observations, and making a survey of his route, which enabled him to complete an exceedingly good map of the country he traversed. As Mr. Elias's Memoir and map are published in the recent volume of our 'Journal,' and are consequently in the hands of Fellows, I need not further dilate upon the subject here. Another memoir, in the same volume of the 'Journal,' entitled 'A Journey through Shantung,' by Mr. John Markham, our Consul at Chefoo, gives us a mass of exceedingly curious and novel information regarding this picturesque and wealthy province of China, and especially regarding the city of the great Chinese sage Confucius, which place was visited and

studied under unusually favourable circumstances by Mr. Markham. A third paper, published in our 'Proceedings,'* by Mr. Alexander Wylie, gives an account of a journey made by the author over a part of the interior of China, of which exceedingly little was known, namely, from Ching-tu in Szechuen, overland, and by tributaries of the Yang-tsze, to Hankow.

AUSTRALIA.—In my last Address I had occasion to notice the expedition of Mr. Forrest into the interior of Western Australia, in search of the reported remains of Dr. Leichhardt's party. Since then, this very able Australian explorer has been wisely engaged by the Governor of the Colony of Western Australia, Governor Weld, on a new expedition, having a more direct practical bearing on local interests than the former one. This was to discover a route by land, suitable for general use, between Swan River and Adelaide. The route would be along the same tract of coast-country, round the great Australian Bight, which was the scene of the great efforts and sufferings of Governor Eyre in 1840-1. Governor Weld's expedition, which has attracted considerable attention in our Australian colonies, I rejoice to add, has been successful, and a narrative of it, illustrated by a sketch-map, will appear in the next volume of the Society's 'Journal.'

Mr. Forrest's party left Perth, Swan River, on the 6th of April, 1870; reached Fowler's Bay, in the settled districts of South Australia, on the 27th of July, and Adelaide on the 28th of August. The line of march was generally near the coast; but at intervals short trips were made inland, for a few miles, to ascertain the nature of the country. By an excellent arrangement, a schooner with provisions and stores was sent along the coast, touching at three distant points, and carrying that succour to the Expedition which was so indispensable in the arid, desolate region over which it travelled. The country, to Long. 124° 25′ E., was found destitute of permanent water. A little further east, an effort was made to push for the water mentioned by Eyre, in Long. 126° 24′, and Lat. 32° 14′ 50″; and, after eight days of toilsome march, it was re-discovered. Some part of this district was found to be a fine, grassy, level country, about 300 feet above the sea-level, and moderately wooded; further towards the interior, as far as the eye could reach, the land was equally level, but less wooded. Further east, a fine grazing-country was traversed, superior to the settled

* Vol. xiv., p. 168.

portions of Western Australia. The granite region ends in about longitude 124°; and thence eastward, to the head of the Bight, a distance of more than 400 miles, a limestone table-land constitutes the whole of the coast-country. In short, the general impression derived from the Report of this able pioneer is, that nothing but the absence of permanent water, arising chiefly from the level nature of the land and its altitude above the sea (generally 300 feet), prevents the whole of this extensive coast-region from being a promising country for pastoral settlement.

In other parts of Australia the opening up of the vast unknown interior has been gradually progressing since the remarkable journeys of Macdouall Stuart and Burke and Wills (with those of the parties sent in search of the latter), rather by the continued advance of sheep-farmers, in search of new pastures, than by geographical expeditions. The accounts of these enterprising squatters are seldom brought before our Society; but, lately, we were favoured by Mr. T. Elder with a copy of a letter from one of his *employés* in South Australia, which contained an interesting account of discoveries made to the north of Lake Eyre by Mr. John Ross, who had penetrated, in search of pastoral country, as far as 24° 30′ on the meridian of 137°, and found a well-watered region, with the streams flowing southward into Lake Eyre. The account given by this explorer seems to indicate a fertile region in the very centre of the Australian continent. "The country," according to Mr. Ross, "is one continued scene of mountain, hill, and plain, with permanent watercourses in all directions and of various magnitude." What is still more remarkable is the statement that, by river and lake, there are 300 miles of water in this central region available for steam-navigation. This fine country, it will be found on reference to a map, is situated midway between Macdouall Stuart's track across the continent, and Captain Sturt's "Stony Desert," where the Expedition under the command of this courageous explorer suffered so fearfully from the heat and dryness in 1845. It lies also some distance to the north of Warburton's track in 1866, and seems a northerly continuation of the tract of well-watered and, to some extent, swampy, country traversed by this last-mentioned traveller.

If the favourable account given by Mr. Ross be confirmed by subsequent exploration, and the promising appearance described by him be not the effect of an unusually propitious season, the ideas generally entertained of the barrenness of the Australian interior will have to be greatly modified, and the colonists are to

be congratulated on the promising future they have before them. At any rate, these and other accounts go far to confirm the opinion of those, who believe that the fertile and barren districts of Australia lie in meridional bands, or in long belts from north to south. To geographers it is peculiarly gratifying to learn, that the progress of settlement and civilisation follows in Australia the lines of route of the great geographical expeditions. It is thus that the telegraph, now in course of construction from Adelaide to the northern shore of the continent, will be laid along the line of march of our medallist Macdouall Stuart.

The Trans-Australian Telegraph, just alluded to, has, indeed, followed rapidly in the wake of geographical discovery. It will have a very important bearing on many topics which have interested the Royal Geographical Society in former years, and is remarkable as demonstrating how quickly Macdouall Stuart's arduous and apparently unprofitable journeys have been made the basis of commercial advancement.

In my Address for 1865,* I gave a rapid summary of the progress of discoveries in this vast country. Commencing with the small area around Sydney—all that was known to the world in 1830—they have extended over two-thirds of its area; now, for the most part, occupied, in a wonderfully rapid way, by enterprising settlers. So rapid has been the progress, that we are apt to forget that it was only in 1862 that the continent was first crossed from south to north by our brave medallist Macdouall Stuart. On July 25th, in that year, he reached the sea south of Melville Island. For his previous and tentative journeys the Royal Geographical Society awarded him a gold watch in 1858, and its Patron's Medal in 1860. In presenting the medal to the Duke of Newcastle on his behalf, I remarked that this journey would not only cause the occupation of the intermediate country,† but would soon lead to the formation of regular settlements on the north coast of the continent: ‡ a prediction fully verified in the establishment of the colony at Port Darwin, and the rapid progress of settlement from the southward. And, further, referring to the prospect of future telegraphic communication, I expressed a hope that the first message should be coupled with the name of our late medallist

* 'Journal,' vol. 35, pp. cxxxiv.-cxliv.

† Ibid., vol. 31, 1861, pp. cviii.-cix.

‡ I have repeatedly advocated the establishment of a Northern Colony. See Addresses, 1859, pp. ccxx.-i.; 1861, p. cviii.; 1862, p. clv.; 1863, pp. clxii.-clxx.; *1865, p.* cxlvii.

"Macdouall Stuart." It would have been a bold prophecy that should have predicted so early an extension of this very line of communication. Considering the rival interests between Queensland and the eastern colonies, it is remarkable, that this most western route across the continent should be the basis of the first telegraphic enterprise to connect Australia and New Zealand with the rest of the world.

The legislative sanction of the South Australian Government to the telegraph scheme of Mr. Charles Todd was given in September, 1870, and the surveying parties immediately commenced their operations. The line passes in a northerly direction from Port Augusta, at the head of Spencer Gulf; then along the routes of Stuart, passing Mount Margaret, his final starting-point. At the end of February last, the line was completed and in operation beyond this, and by this time has probably reached the tropic. At the northern end it proceeds to the south-east on leaving Port Darwin, threading a most fertile country, equal, for pasturage and settlement, to the best parts of South Australia, and striking Stuart's track in about lat. 13° 14′ s., within 50 or 60 miles of the north coast. Any doubts regarding the accuracy of Stuart's narrative have been entirely dispelled by the telegraphic parties, who found his camp-trees marked with his initials, and also the recent tracks of a horse, which must have strayed from him, as he relates, seven and a half years previously. Throughout the survey, both in the north and the south, our traveller's reports of the country are entirely confirmed.

The length of this line of telegraph will be about 1800 miles. It is much aided by the circumstance that the River Roper, passed by Stuart, has been found navigable for a considerable distance from the Indian Ocean, affording a ready means of transport for the *matériel*. By means of this telegraph, the northern colony at Port Darwin will be placed in immediate connexion with Java, Singapore, and India, on the one hand, and with the rest of Australia on the other: from both of which directions its prosperity must come. In the interior of the continent, destitute of navigable rivers, and with wide areas suffering periodically from drought, the line will afford a perfect safeguard to settlers or travellers who may be within its range; as, should any adverse circumstances arise, they can at once make their wants known where aid can be obtained. This completion of the telegraphic system from one extremity of the globe to the other will finally solve another problem important

to us, namely, the exact and final determination of geographical positions. I may remind you that this was one of the original objects of the Society, the attainment of which at that period could only be arrived at by long and laborious astronomical and trigonometrical operations, with results known to be open to considerable doubt.

Thus, in our early days, our medal was awarded, in 1836, to Captain Robert FitzRoy, for his surveys, one portion of which was the first complete chain of meridional distances carried around the globe. Yet, with the most refined precautions, the entire series was 33′ of time, or above 8′ of arc, in excess; a portion of which was made at Rio Janeiro at the commencement of the chain. Again, in 1840, Lieut. Raper, R.N., received our Founder's Medal, chiefly for his elaborate discussion of the longitudes of the principal maritime places of the world, which showed how large were the discrepancies, and how much doubt was cast on the best-ascertained meridians. The electric telegraph determines instantly and with perfect accuracy, which is unattainable by ordinary geodetical operations, the differences of longitude between the observing-stations,—a process which has been carried out for all the chief parts of Europe and America. A notable example of this was given in the electrical determination of the difference of longitude between Greenwich and Paris, believed to be the most accurately known of all. After nearly a century of continuous and indefatigable measurements, it was believed to be somewhere between 2° 20′ 15″ and 2° 20′ 24″ of arc; but in 1854 M. Le Verrier determined, from a mean of nearly 2000 electric signals, any single one of which was more accurate than all the previous measurements, that the true difference is 2° 20′ 9·45″ of arc, or more than a second of time (a large quantity in astronomy) less than previous results.

New Zealand.—Dr. Haast, the very able geological surveyor of Canterbury Province, New Zealand, has sent us a valuable contribution on the physical geography and topography of the New Zealand Alps, in continuation of his important memoirs published in volumes xxxiv. and xxxvii. of our 'Journal.' The recent paper, which he modestly puts forth as Notes to accompany his Topographical Map, which itself is a magnificent addition to New Zealand geography, contains some observations of striking interest on the changes which have preceded the present physical condition of this central part of the Southern Island. It is by such observations that the science of geology is brought into close connexion

with that of geography, and the conclusions are of equal interest to the students of both these great branches of human knowledge.

Dr. Haast compares the snow-clad mountains of the Canterbury Province, which, as you are aware, lie parallel and near to the western coast of the island, to the Alps of Europe; and shows the similarity between the two in their glaciers, and especially in the action of the warm winds, which, blowing from hotter regions, cause a rapid melting of the snow on the side of the mountains facing the direction of the wind. In fact, all the principal meteorological phenomena encountered in the European Alps occur also in New Zealand, the "nor-wester" of the latter country being the representative of the "föhn" of Switzerland. The nor-wester having blown over a wide extent of ocean, and become charged with moisture, is the chief source of the copious precipitation which, in the form of snow, caps the New Zealand peaks, and forms those large fields of névé which supply the great glaciers of the country. The glaciers and snow-fields are stated by Dr. Haast to exceed in dimensions those of Switzerland; and he adduces further proof of the curious fact, which had already excited much interest among physical geographers, that glaciers descend much lower on the western than on the eastern slopes of the mountains, and on the West Coast are in close contiguity to a luxuriant forest vegetation, consisting of pines, arborescent ferns, and flowering shrubs; such, for example, are the Francis Joseph and Prince Alfred glaciers. On the eastern side, although of larger dimensions, they descend in the Canterbury Province no lower than 2500 feet above the sea-level. The cause of the difference is owing partly to the smaller amount of moisture on the eastern, or leeward side, and partly to the less abrupt slope. Large as the New Zealand glaciers and snow-fields are at present, they were formerly, in post-pliocene times, much more extensive: proofs of this are seen in all directions, in vast moraines heaped around the lakes lying at the foot of the mountains, and in marks of glacier action at levels far below their present limit. Dr. Haast believes that the elevated plateau districts, which support the névé fields, were at that time much more extensive, and that glaciers, reaching the sea, gave off from their extremities detached portions, which floated away to the North as icebergs, as they do in Greenland at the present day.

With regard to other parts of these important islands, I may mention that a lively picture of the volcanic districts of the Northern

Island of New Zealand was given in Lieut. Meade's journals, published last year; and that a valuable Paper on the Province of Southland, by Mr. Marten, has recently appeared in Mr. S. W. Silver's 'Circular and Colonial News.' This Paper is one of the results of a printed series of suggestions and queries regarding physical geography and statistics which Mr. Silver issues to his numerous correspondents in all parts of the world where commercial relations have been established.

New Guinea.—The proximity of our new settlement at Cape York, and the number of vessels engaged in the pearl and Bêche de Mer fisheries in Torres Straits, have led to more frequent communication with the natives of that great and still almost unknown land, New Guinea. In my last Address, I had occasion to notice a visit made by Captain Delargy to a village on the southern coast of the island, concerning which the most remarkable circumstance was the friendly welcome accorded to the strangers by the distrustful and warlike natives. Since then we learn from an official report of Lieutenant Chester, the Government Resident at Somerset, Cape York, that he himself visited a native settlement on the south coast, in company with Captain Banner. It appears that a display of armed force and great precaution are necessary in these undertakings; and the native interpreter brought from Warrior Island, in the Straits, was careful to recommend to Lieutenant Chester to say to the Papuan chief of the village that, although desirous of being on friendly terms with him, he was prepared to fight if the natives preferred it. No progress, in fact, has been made towards winning over these formidable people to peaceful commercial relations with the traders of the Australian seas; and not a little of the difficulty, according to Lieutenant Chester, arises from the criminal plundering of the native plantations by boats' crews landing on the coast. Unprovoked aggression on the part of the Papuans, he believes, is not likely to occur, as their well-constructed villages and large well-fenced plantations are too valuable to be lightly risked. An interesting item of ethnological information contained in his narrative, is the existence of wild tribes of aborigines in the interior, with whom the agricultural coast villagers are in frequent hostility.

South America.—In the continent of South America the work of exploration and survey is making steady, if somewhat slow, progress. Several of the independent Governments are now, or have lately

been, engaged in the systematic survey of their vast and thinly-populated territories, publishing the results in maps of greater or less completeness. Thus, the Republic of New Granada, now called the United States of Columbia, lately brought out an Atlas founded on the incomplete surveys of Codazzi; and the prosperous State of Chili, as I had occasion to record in my last Address, is following the example, by issuing well-prepared maps of its central provinces. In the great Empire of Brazil no accurate official survey has yet been instituted of any large portion of the country, but partial surveys, particularly of the Southern Provinces, the River San Francisco, and large portions of the Amazons have been executed; and we have lately learned that an Imperial Commission has been appointed for the preparation of a general map of Brazil, in which the material furnished by all these local surveys will be for the first time made available to geographers and the public in cartographical form. The Commissioners have been in correspondence with our Council, through our Medallist Mr. Chandless, with a view to the amicable interchange of geographical information.

The Government of Peru has continued the laudable work of exploration of the little-known interior of their country, to which I alluded in the Anniversary Address of 1869. For my information regarding the progress since made, I am indebted to our able corresponding member at Lima, Don M. Felipe Paz Soldan. According to his Report to our Council, the general survey of the more important rivers of the trans-Andine territories of Peru has continued without interruption; the Government of Peru attaching much importance to this work, as being indispensable to the peopling of these fertile regions, and the opening-up of communications with Europe by way of the Amazons and the Atlantic. River steamers have been built and costly establishments maintained, directed by European and North American engineers and surveyors, in pursuance of this great object. The exploration of the Rio Utcubamba and others has been entrusted to Mr. Arthur Wetherman, who has made an accurate survey, fixing numerous points by astronomical observation. The Pachitea River has also been more carefully examined, and found to be easily navigable,—a result of much importance, as it confirms the hopes that a great commercial route will be soon established, leading from the peopled districts of Peru to Europe by means of the Amazons (with which the Pachitea communicates) and the Atlantic Ocean. A little further south, the survey of the large rivers flowing towards the Amazons from

the neighbourhood of Cerro de Pasco and its silver-mines has been undertaken. Three rivers—the Paucartambo, the Occobamba, and the Chanchamayo—here unite to form the Perene, a stream 350 feet broad and 3 fathoms deep. The interesting problem still remains to be solved, whether the Perene is navigable to its junction with the Tambo and the Ucayali; in which case a river-navigation of enormous length, by steamers, will be possible from the Atlantic to within a moderate railway-ride of Lima.

An important contribution to our knowledge of the river-systems of South America is the result of the Surveys of the Rapids of the Madeira River, by Messrs. Joseph and Francis Keller, engineers in the service of the Brazilian Government. The object of these surveys was to ascertain what engineering works will be necessary, in order to overcome the obstacles which these Rapids offer to rapid communication, between the Atlantic and the interior provinces of Brazil: a question in which the Republic of Bolivia is also greatly interested, for the River Madeira appears to offer to the rich interior provinces of that country by far the readiest means of communication with Europe. According to the survey of the Messrs. Keller, there are no fewer than 18 cataracts and rapids, in succession, on the Madeira, obstructing navigation between the Mamore and the River Amazon, having a total fall of water of 228½ feet in an extent of nearly 230 miles. A railway has been proposed as the best means of avoiding these great obstacles.

From British Guiana we have had, during the past year, the details of the discovery of a waterfall, of great height and remarkable beauty, called the Great Kaieteur. This fall is situated on the River Potaro, a tributary of the Essequibo, on the left bank. It was first discovered by Mr. Charles B. Brown, of the Geological Survey of the Colony, in April, 1870, and described by him as formed by the River Potaro precipitating itself over the edge of the sandstone table-land of the interior, into the lower country of the Essequibo Valley. The total height was found to be 822 feet, and the width of water, at the edge of the fall, 123 yards. So interesting a discovery excited much attention on becoming known at Demerara, and Governor Scott commissioned Mr. Brown to make a second visit in June to make a more complete survey; the official Report resulting thereupon giving us most satisfactory details as regards the falls, as well as the geological and botanical features of the district. Thanks to the Geological Survey of this important tropical Colony, we are now tolerably well acquainted with its lithological structure and

mineral productions, and it is to be hoped the result will be published in a form accessible to the public. In the discussion which followed the reading of Mr. Brown's Report at our evening meeting, Mr. J. G. Sawkins, the Director of the Survey, alluding to the flat-topped mountains and table-lands which form so peculiar a feature in the scenery in the interior of British Guiana, gave a vivid description of Mount Roraima,—first visited by Schomburgk,—the most remarkable of these elevations. It is a huge mass of light-red sandstone rock, 18 miles in length, with perpendicular sides and perfectly level summit, rising 7500 feet above the level of the sea. The flanks, forming bare, vertical walls 1500 feet high, are insurmountable; but the summit is known to be the source of several streams, which leap from the edge of the plateau in magnificent cascades, and flow in different ways to feed the Essequibo, the Orinoco, and the Amazons.

At the southern extremity of the continent a remarkable journey was performed in 1869-70, by Lieutenant G. C. Musters, throughout the whole length and breadth of Patagonia, a country hitherto deemed one of the most inhospitable in the world, and inaccessible to travellers on account of the hostility of the savage tribes who wander over its desolate plains. The account of his journey, given by Mr. Musters at our evening meeting of the 13th December last, excited the liveliest interest. Scarcely anything was previously known of the interior of this country, as will be seen on reference to the excellent summary of Spanish and other expeditions, given by our secretary, Mr. Markham, on the same evening.* In fact, little more than short excursions inland from the coast had been made, throughout the vast extent of land between the Straits of Magellan and the Rio Negro. Mr. Musters traversed the whole of this unexplored region, first crossing from Punta Arenas, in the Straits, to Port Santa Cruz, then in company with a tribe of Patagonians, whose goodwill he had succeeded in gaining, skirting the eastern flanks of the Andes for 700 miles to the Rio Negro, and finally recrossing to Patagones, near the mouth of this river. Mr. Musters's paper,—which will be published entire in our 'Journal'—gives us much new information concerning the rivers, lakes, soil, and climate of the country, and especially of the peculiar character and habits of the aborigines. His journey may, indeed, claim to be ranked among the most adventurous and successful of those

* 'Proceedings,' vol. xv. p. 49.

which have recently been undertaken by our enterprising fellow-countrymen.

Arctic Exploration.—Of the numerous Expeditions which have been sent by Sweden, Germany, and the United States of America to explore the North Polar Regions, since the days when England took the lead in that field of hardy enterprise, the voyage of Count von Zeil and Herr von Heuglin last summer, in East Spitzbergen, has probably offered most novelty to geographers. This undertaking was carried out in the months of July, August, and September, and its object was to penetrate to the eastern channels and islands of the Spitzbergen group, which had not been visited by the previous Swedish expeditions under Nordenskiöld, Von Otter, and others, and, in fact, had hitherto remained little better than a blank on our maps. That blank, thanks to the enterprise of these gentlemen, is now filled up, and the information imparted, owing to the well-known scientific qualifications of Herr von Heuglin, is exact and comprehensive. The small vessel in which the party sailed proceeded, first towards Edge Island or Stans Foreland, and, on finding the ice not yet cleared from the south-west coast, struck westward and then northward, navigating the whole length of Stor Fjord as far as Helis Sound. Landings were effected at many places on the east coast of the main island of Spitzbergen, as well as on the two large islands to the eastward; excursions were made in the interior, and astronomical observations and bearings taken to fix positions, besides large collections obtained in illustration of the natural history of the group. At length, in the middle of August, they succeeded in passing by boat through Freeman, or Thymen Strait, to the eastern side of Stans Foreland, and from Mount Middendorf, a hill on the shore of the strait 1500 feet high, were gratified at beholding in the far distance to the east a large tract of land, with a range of lofty serrated peaks extending north and south for nearly 60 miles. Whether this land is the enigmatical Gillis-land, of which we have so often heard, appears not fully decided, but unquestionably these enterprising German voyagers have brought us for the first time definite information regarding this unvisited region. In returning, they skirted the western coast of Stans Foreland and visited Deicrow Sound, at its south-west extremity, early in September, before turning their faces homeward.

According to Von Heuglin the passability of these seas and channels entirely depends on the direction of the various branches

of the Gulf-stream and of the Polar current. The latter divides, in the high north, into two branches, one of which flows down the eastern side of Greenland, and the other down the eastern side of Spitzbergen; the Gulf-stream presses north-eastward, washing, therefore, the south-westerly sides of the Spitzbergen Archipelago. These currents have a decisive influence on the climate of the coasts; where the Gulf-stream flows the ice becomes more quickly broken up, and a milder temperature is communicated to the air; but the Polar current, scarcely higher than freezing point, even in the height of summer, keeps the ice in its neighbourhood from separating until the beginning of September, when a little is broken up and drifted south. It is, therefore, only in the latter part of the summer that the North Polar Sea is at all accessible.

This Expedition appears already to have stimulated other German efforts to follow up the same promising line of Arctic investigation; for I learn by a recent German publication that a small Norwegian vessel is to be equipped this summer, and a reconnaissance survey of the sea between Spitzbergen and Gillis-land to be made by Lieutenants Payer and Weyprecht, at the cost of the Austrian Government. The Swedes on their side are proposing to establish a permanent astronomical, magnetic, and meteorological station at Spitzbergen, with a view of preparing the way for renewed Arctic exploration; Professor Nordenskiöld, who already enjoys a high reputation as an Arctic explorer, having the intention next year of making a vigorous attempt to reach the North Pole, making the proposed Spitzbergen establishment his base of operations.

Regarding the German North Polar Expedition of 1869-70, under Captain Koldewey, in the *Germania* and *Hansa*, our Society has had the advantage of hearing an excellent account of this adventurous voyage and its results from the pen of Sir Leopold McClintock, who is so well qualified by his great Arctic experience to do justice to such a subject. Naturally basing his narrative on German accounts of the Expedition, especially that given in Petermann's 'Mittheilungen,' Sir Leopold limited his own remarks to well-deserved praise of the ability with which the details of the enterprise were carried out, and especially the endurance of the heroic crew of the *Hansa*, who, having to take refuge on an ice-floe in the open sea, on the destruction of their vessel in a fearful storm, were drifted southward several hundred miles, to within reach of a Danish settlement near the southern extremity of Greenland. As far as geographical discovery is

concerned the Expedition did not accomplish much, but the staff of scientific men belonging to it succeeded in amassing a large amount of material in all branches of science, which we are assured will prove, when published, of great value. The *Germania* wintered near the southern end of Pendulum Island, near the locality of Sir Edward Sabine's magnetic observatory, when he visited the locality with Captain Clavering in 1823. From this point sledging expeditions in the spring of 1870 were undertaken, which reached as far as 77° north latitude. In returning down the coast a fiord, penetrating far into the interior of East Greenland, was discovered and partly explored. It is situated between Capes Franklin and Humboldt, and was found to be surrounded by a highly picturesque mountainous country, with sheltered and verdant pastures near the water, inhabited by herds of musk-oxen and reindeer. Some of the peaks in the neighbourhood were found to reach the height of upwards of 7000 feet. These inlets of deep navigable water, possessing a mild climate and abounding in animals, but unpeopled by Esquimaux tribes, seem to be most promising avenues to the exploration of the interior of Greenland, and it is to be hoped that some of our young English geographers, desirous of earning fame as discoverers—of whom I am proud to say we still number a few amongst us—will devote their energies and means in following up the opening thus indicated. From our Government, I deeply regret to add, no aid is to be expected.

I ought to mention, in connexion with this important voyage of Koldewey, which is designated the "Second German North Polar Expedition," that a Society was founded, last autumn, in Bremen, called the German North Polar Society, having for its object the promotion and management of all German efforts in the direction of Arctic enterprise. This Society has already held fourteen meetings, and publishes its proceedings. An important part of its present labours is the publication of the results of the voyage of the *Germania* and *Hansa*, of which the first volume is said to be ready for the press.

Before I quit the subject of Arctic enterprise, I must not omit to mention that our relatives and rivals on the opposite side of the Atlantic have furnished the means to equip the well-known Arctic traveller, Mr. Hall, for another journey, during the present summer to the Polar regions, from the American side. Dr. Bessels, a German savant, who has acquired Arctic experience in a former voyage to Spitzbergen, is engaged as zoologist to this expedition,

and Dr. D. Walker, one of our associates, formerly surgeon to McClintock's exploring party, as I learn from a letter he has written to the Council of our Society, has also been engaged to accompany it. Having been furnished with a set of instruments on a former occasion for observations in Arctic America, our Associate has obtained permission to employ them in the American Expedition, and, I trust, we may receive from his pen, at a future day, some account of the exploration on which he is now engaged.

Whilst on the topic of Arctic discoveries, I am happy to be able to announce that our distinguished Associate, Captain Allen Young, intends to explore, as far as possible, and at his own cost, the interior of the fiords of East Greenland, and to devote future years in making geographical discoveries in his own yacht.

Again, I have just learnt from Mr. William Bradford, of New York, that in a vessel of 400 tons, manned by a crew of Nova Scotians, he has taken photographic sketches of all the principal features on the west coast of Greenland, up to latitude 76°.

In this survey he was accompanied by our Medallist, Dr. Hayes, and he speaks in high commendation of the bravery and ability displayed by the young British colonist who commanded his vessel.

AFRICA.—Concerning Africa, which usually offers so much geographical interest and novelty, I have this year but little to report, as regards discoveries by English travellers. The great Expedition of Sir Samuel Baker was, by the last accounts, slowly working its way, by the Giraffe arm of the White Nile, towards Gondokoro and the Albert Nyanza, and had, therefore, not yet entered upon the field where so much yet remains to be accomplished in the way of new exploration. In the south, we have received an account of the explorations of Mr. Thomas Baines, in the region between the Limpopo and the middle course of the Zambesi; in which direction this persevering traveller has been employed in examining the locality of the gold-fields and negotiating the privilege of working them with the Matabele chiefs. Mr. Baines' narrative (compiled from his itineraries by Dr. Mann) will appear in our 'Journal,' and his map will be seen to offer, for the first time, an accurate delineation of the watershed which limits, in that region, the Limpopo and Zambesi basins.

Dr. Livingstone.—The recent advices from Dr. Kirk, which were kindly communicated to me by Earl Granville, must have been

truly gratifying to all my Associates to whom I communicated them, as well as to the public at large. I have now a confident belief that the illustrious traveller was safe and well a few months ago.

Knowing that he was about to be fully supplied with provisions and medicine when he reached Ujiji from the west, we may anticipate that he might return to his native country in the course of this year.

But I now repeat the expression of the opinion which I published in my Address at the opening of the present Session, that if he had not, in his explorations, satisfied himself that the waters which he had followed from the south flowed into the Nile basin by the great lake Albert Nyanza, he would renew his arduous endeavours to solve the great problem of the true watershed of Southern Africa. The indomitable spirit of Livingstone would, in this case, prompt him to struggle until that great point was settled.

Even, however, as matters now stand, the last intelligence was a very cordial to myself, who have so long and so persistently looked to the eventual success of my absent friend.

Schweinfurth's Journey.—Whilst waiting for the account of the discoveries which Dr. Livingstone cannot fail to have made in the region west of Lake Tanganyika, geographers have been gratified to read, in Petermann's 'Geographische Mittheilungen,' the narrative of the explorations of the indefatigable German botanist Dr. Schweinfurth, in the region west of the White Nile and far to the north of the scene of Livingstone's explorations. As you are all aware, the accounts we had previously received of this portion of the African interior were limited to the narratives of Petherick's two journeys of 1858 and 1862, and to the accounts of the Expedition of the late Miss Tinné from the mouth of the Ghazal River to beyond the Djour. Since those remarkable journeys, we had heard only in a vague way of discoveries by the agents of the Messrs. Poncet, ivory-traders in those districts; and also of the journey, far to the south, of Signor Piaggia, who, having been received in a friendly manner by the chiefs of the Niam-Niam tribes, was able to travel further to the south-west than any of his predecessors, and brought back a report of the existence of another great lake in that direction. The accounts of these last-named travellers, however, did not admit of being delineated with any approach to accuracy on our maps; whilst from Dr. Schweinfurth, who is still engaged following up his investigations, we have a

large body of accurate information, founded, in the absence of astronomical observations—for which he had not the necessary instruments—on a carefully-made route-survey. He has succeeded in reaching a point about 50 miles beyond Piaggia's furthest, and 210 miles to the west of the White Nile, nearly on the same parallel as the northern end of Albert Nyanza; but he does not confirm the Italian traveller's rumour of a great lake so far to the west. His most important discovery appears to be that of a river, the Uelle, flowing westward, probably into Lake Chad, proving that he had crossed the watershed of the White Nile on the western side of its basin.

Connexion of Geographical with Geological Science.

In the Anniversary Addresses delivered by me to the Society during the last three years, I have dwelt upon the connexion between geography and geology, more particularly in the direction of Physical Geography. From the evidence furnished to us by the rocks around us, whether of a physical or a palæontological kind, we are able to re-construct, in part at least, former conditions of the earth's surface, and to learn how the present outlines of land and sea, and the present distribution of plants and animals, are not original, but only the latest phases of a long-preceding succession. Geology thus becomes to us what I termed "the oldest comparative geography."

It is unnecessary for me to point out that just as in descriptive, and still more in physical geography, it is of primary importance to have regard, not merely to the external contour and climate of a country, but to the grouping of its plants and animals, so in geological research it is absolutely necessary to make constant appeals to the evidence furnished by the remains of the flora and fauna of ancient periods. Hence, though at first sight there might seem to be no very close or necessary connexion between geology, or, at least, that aspect of geology which I have called the oldest comparative geography, and the more purely biological sciences, there is in reality an intimate relation of the one to the other. And thus, in these my final and parting words to the Geographical Society, while I again bring under your notice the claims which the progress of Geology makes upon you, I wish to refer to this

relationship, not alone for its own interest and importance, but because it gives me an opportunity of expressing a growing conviction of my later years that, alike in geographical and in geological research, we run some risk of being overshadowed and even elbowed out of an essential portion of our proper course as geologists by the paramount demands of some eminent biologists. No one who knows what my connexion with geological study has been will allow himself to suppose that in what I now say I would in any way depreciate the due importance of the biological branches of that science. I have indeed been accustomed, throughout my career, to bow to the weight of palæontological evidence, and to this, my earliest and latest faith, I still remain true. But I cannot shrink from thus publicly expressing a feeling which has recently grown strong within me, that the biological side of geology has by some of my cotemporaries been too exclusively cultivated; that palæontology has acquired a somewhat undue preponderance amongst us; and that the value of physical or inorganic geology is not now being sufficiently appreciated. If, indeed, men were in any measure agreed as to the origin and progress of the various forms under which life has been manifested in the history of the world, if they had arrived at a common understanding as to the value of species, if they knew with any approach to completeness how far life is dependent on, and modified by, external physical conditions now, and how far similar relations have obtained in the past, there might be some show of reason for the paramount authority of palæontological decisions when they are set against physical data. But when we reflect on our slight acquaintance with the laws which regulate the interaction of organic and inorganic nature at the present time, on our ignorance of that interaction in former geological periods, on the little that we know regarding the true value of our fossil species, on the difficulty of ascertaining the true contemporaneousness of distant formations, and on the vast mass of fossiliferous rocks still unexplored, it does seem to me that greater modesty and caution in the application of palæontological *dicta* are to be recommended. Whatever may be the doctrine we espouse as to the origin of species, we see on every side of us in the living world of to-day how constantly, and how momentously, the conditions of life are defined and modified by inorganic forces. Apart from, and imperiously governing the progress of life around us, *there is* the world of physical or inorganic nature—a system of

ceaseless law-directed change, of endlessly complicated agencies working harmoniously together and involving all things, organised and unorganised, in one common mutability. If such is the order of nature now, and if our view of nature would be but partial and distorted, in contemplating merely the biological domain, surely we err when we, in like manner, allow ourselves to see things in the past too exclusively through that medium, and neglect to take due cognisance of the evidence of former physical changes.

By neglecting the study of physical geography, geology has become, among certain influential writers, too much the study of palæontology only. Those writers must not forget that there has been a history of dead matter as well as a history of life; that mineralogy, petrography, structural and stratigraphical geology, and physical geography, deal with essential and integral parts of the past history of our planet. Things, indeed, have gone so far, that when there is a confliction of evidence between the testimony of the fossils and that of the rocks in which they lie, such authors, almost invariably, and as a matter of course, bow to the palæontological argument. I have myself done so, even against what I may perhaps have thought, or, at least, think now to have been my better judgment. I cannot but believe that, ere long, a reaction will set in against this tendency. And, in the mean time, some geologists will do well to pause in their too exclusive worship of the biological side of their science. I wish to put this note of warning on record, and to urge my brethren of the hammer to believe that, in the study of fossils, they do not exhaust the possibilities of geology; that there is still a wide non-biological world for them to conquer; that in proportion as they master it they will advance to truer and more comprehensive views of the history of life, and thus aid us in the investigation of that planet with which we, as geographers, are specially concerned.

Conclusion.—In concluding this Address, I now come to the only painful duty I have ever had to perform, since I have had the honour of presiding over the Royal Geographical Society.

I have to bid you farewell, and I do so solely on account of the malady with which I have been visited; for I well know, that if I had not felt it incumbent on me to resign the Chair, your never-failing kindness would have urged me to continue to serve you until the next Anniversary.

In retiring, I have the satisfaction of knowing, that I leave the Society in the most highly flourishing condition, and that I can reflect with just pride upon the progress it has made since the year 1843, when, succeeding to your excellent President Admiral Smyth, I was, by his advice, first placed in the Chair. In the period which has elapsed since that date, I have been for fifteen years your President; and when other persons have been in that post, I have zealously aided them to sustain your interests, and have prepared and read to you sixteen Anniversary Addresses.

In my endeavours to serve you, it was with the heartiest satisfaction that I supported the endeavours to extend Arctic Discovery; and either when I wished God speed to my lamented friend Sir John Franklin, or when that great navigator was missing, I can reflect with honest satisfaction on the fervent—though, alas! vain—appeal I made in your name to Her Majesty's Government, to endeavour to rescue him and his brave companions. Then, again, when his devoted wife made that final effort which, through the researches of Sir Leopold McClintock, terminated in establishing the truth as to the fate of those brave explorers, so I never relented in my support of that magnanimous woman, Lady Franklin, until I had the true gratification of presenting to her, in your name, one of our Gold Medals for her heroic efforts.

It would be very bad taste on my part were I to advert to the many instances in which I have been intimately concerned in acts which I know that the Fellows of the Royal Geographical Society have duly appreciated as being of importance. Among these I need not remind you of the attainment of the support of Parliament, and thereby of our recognition as an important and highly-useful scientific body.

Amidst the many duties which it has been my good fortune to perform, I can dwell upon none with more satisfaction than those by which I sustained the daring efforts of the explorers of Africa,—Livingstone, Speke, Grant, and Baker; whilst I have rejoiced in the steadfast pertinacity with which I have upheld my confidence in the ultimate success of the first-named of these brave men. In fact, it was the confidence I placed in the undying vigour of my dear friend Livingstone which has sustained me in the hope that I might live to enjoy the supreme delight of welcoming him back to his country.

I have now only, gentlemen, to offer you my heartfelt thanks

for the unvarying heartiness with which you have supported your old President, whose name was, by your kindness, the only one inserted in the Royal Charter by which you are embodied, and who leaves you with feelings of just pride when he reflects that he has been thus identified with your past and future successes, and that your numbers, which amounted to 600 only when he first was placed in the Chair, have now risen to the large total of 2400.

If, as I hope, you elect Sir Henry Rawlinson as my successor, I anticipate the most gratifying results in your future career; for you will be led forward by an eminent scholar and great explorer, who, as far back as the year 1839, won one of your Gold Medals for his most remarkable researches in Susiana and Persian Kurdistan, and who also determined the former existence of the ancient cities of Ecbatana, and threw quite a new light on the comparative and physical geography of Western Asia.

Since the days of his early researches, which we geographers were the first to recognise and reward, he has rendered his name famous by his able and elaborate works on ancient Babylonia; and whilst on every subject relating to Central Asia he has evinced much knowledge, we have had to thank him for the perspicuity with which he brought our late lamented envoy Mr. Hayward to our notice.

Under his auspices you are destined not only to direct the exploration of vast unknown lands, but also to bring to the mind's eye of moderns many of the past glories of the great eastern empires of antiquity.

Postscript.—Whilst on the point of concluding my Address, I received the melancholy announcement of the death of my old and valued friend Sir John Herschel. This truly eminent man, whose acquirements in every branch of science were almost unrivalled, although not a Fellow of our Society, was an admirable geographer in the largest sense of the word. He had worthily received the highest honours which could be conferred upon him by every scientific Academy of the world; and in 1845 he presided over the British Association for the Advancement of Science, at Cambridge.

The mention of this fact leads me naturally to take this last opportunity in my power of leaving behind me a record, however brief, of the high merits of another most distinguished leader—

indeed, he was the Law-giver—of the British Association, though he also was not a Fellow of our Society. I mean the Rev. William Vernon Harcourt, to whom I was most truly attached, and who succeeded in giving so great an impulse to the spread of true scientific knowledge. I have no doubt that the President of the Royal Society, Sir Edward Sabine, will do ample justice to the scientific characters of these two remarkable men, who, as well as myself, were long associated with them in conducting the business of that great national body.

PROCEEDINGS

OF

THE ROYAL GEOGRAPHICAL SOCIETY.

[ISSUED DECEMBER 18TH, 1871.]

SESSION 1870-71.

Thirteenth Meeting, 12th June, 1871.

MAJOR-GENERAL SIR HENRY C. RAWLINSON, K.C.B., PRESIDENT, in the Chair.

ELECTIONS.—*Sir Frederick Arrow; Joseph Hargrave, Esq.; Lieut. J. A. MacVicar; J. P. Radcliffe, Esq.*

ACCESSIONS TO THE LIBRARY FROM MAY 8TH TO JUNE 12TH.—Mitchell's 'New School Geography.' Philadelphia, 1870. Purchased. Guyot's 'Common-School Geography.' New York, 1870. Purchased. 'Elements of Physical Geography.' By J. Brocklesby. Philadelphia, 1868. Purchased. 'On Hlonipa, a Kafir Custom.' By D. Leslie. 1870. Donor J. Sanderson, Esq. 'On the Dispersal of Non-migratory Insects by Atmospheric Agencies.' By A. Müller. 1871. Donor the author. 'Progrès de l'Hellenisme.' By Major F. Millingen. Braila, 1871. Donor the author. 'History of the Imâms and Seyyids of 'Omân, from A.D. 661-1856.' By Salîl-Ibn Razîk. 1871. Translated by G. P. Badger. Donors, the Hakluyt Society. 'Select Letters of Columbus.' Translated and edited by R. H. Major, Esq. Second edition. Donors the Hakluyt Society. 'Travels in the Interior of Brazil in 1836-41.' By G. Gardiner. 1846. Purchased. 'Manual of Spherical and Practical Astronomy.' By W. Chauvenet. 2 vols. Purchased. 'On the Geology of Natal.' By C. L. Griesbach. 1871. Donor the author. 'Kidnapping in the South Seas.' By Capt. G. Palmer. Edinburgh, 1871. Donor the author. 'Census of Switzerland, 1870.' Winterthur. Donor J. M. Ziegler. 'Travels of Fa Hian and Sung-Yun from China to India, 400 A.D. and A.D. 578.' By

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ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING, MAY 8TH. —A revised Map of 'Omàn and the Persian Gulf. By Rev. G. P. Badger, F.R.G.S. Presented by C. R. Markham, Secretary. 50 MS. Maps of Africa, &c., the property of the late James Macqueen, F.R.G.S.,; also a Bust of this celebrated African Geographer. Presented by his daughter, Miss Macqueen. MS. Map of the River Maue-assu, a tributary of the Amazon. Presented by the author, W. Chandless, F.R.G.S. Sketch-map of Easter Island. By Lieut. J. Dundas, R.N. Presented by J. L. Palmer, Esq., R.N. MS. Map of the country south of Trebizonde, shewing the site of the Mt. Theches of Xenophon. By M. Rorit, Esq. A Tracing of the new Course of the Yellow River. By N. Elias, Esq. Map of the North-Eastern provinces of China, shewing the Mineral and Silk Districts. By J. Markham, Esq., Consul at Cheefoo. A Tracing of various localities in Greek characters. Presented by Mrs. Schindler. Explorations round Nova Zembla. By Kapt. E. H. Johannesen. Presented by Dr. A. Petermann. Map of Natal and the Orange Free States, shewing the Diamond-Fields, &c. Presented by Dr. A. Petermann. MS. Map, on 9 sheets, shewing the South African Gold-Field Districts. Presented by T. Baines, Esq., F.R.G.S. Map, shewing the Routes of Dr. G. Schweinfurth to the South-west of Khartum, among the western tributaries of the Nile. Presented by Dr. A. Petermann. A Map of Eastern China (in Chinese characters), in three Parts. Presented by H. G. Hollingworth, Esq. Running Survey of the Po-Yang Lake (China). Presented by H. G. Hollingworth, Esq. MS. Map of the Po-Yang Lake. By W. Stuart, H.M.S. *Elfin*. Presented by H. G. Hollingworth, Esq. A Photograph of the Interior of Eastern Greenland. By Lieut. J. Payer (2nd German Expedition). 1870. Presented by Dr. A. Petermann.

The following Paper was read by the Rev. G. P. Badger:—

Account of an Excursion into the Interior of Southern Arabia. By Captain S. V. MILES, Bombay Staff Corps.

[ABSTRACT, BY THE REV. G. P. BADGER.]

WE left Aden on the 3rd of July, 1870, in a small sambuk, and after a tedious voyage arrived at Bir Ali [a distance of about 220 miles] at 5 P.M. of the 7th, where we met Hadi Abdullah, the

Wahidee Sultan, who received us in a very friendly manner, and gave us accommodation in his house. Found that we should be detained here three days for camels, to be procured from the neighbouring tribe, the Deaybees, who would also furnish us with an escort. This village—which takes its name from the well, Bir Ali—consists of about fifty mat huts close to the sea, in one of which Sultan Hadi resides. The only permanent buildings are a square tower and a few sheikhs' tombs. The country around is quite barren as far as the hills, which begin to rise about 10 miles off. The inhabitants are mostly employed in fishing, and are very poor. The chief product of the country is dates, which are exported to Aden and Maculla. Anthracite coal is found here, and specimens are taken to Aden as coal. There were signs of copper also, and bitumen is found in abundance. To the east, near the entrance of the small circular harbour, is a curious hill, named Shâaran—but generally designated El-Bostân by the Arabs, from an idea that it was in ancient times a garden—having a large cavity, or crater, full of salt water, bordered by mangrove bushes.*

From the western point of the harbour, half across the entrance, is a narrow strip of land from which rises Hisn-Ghorâb, a square, black, solitary rock, placed like a natural fortress to command the bay. The upper part of this gloomy-looking hill is as steep and inaccessible as if artificially scarped. At the foot, on the north side, are the remains of a considerable town, almost buried in the sand. The public buildings were probably situated on the summit, which we ascended the next day by a very difficult road. The formation of the hill is very similar to that of Aden. The foundations and part of the walls of the houses are still standing; I noticed only one cemented with mortar. The tanks and aqueduct are still in excellent preservation. We paid a second visit to Hisn-Ghorâb for the purpose of copying the inscriptions, the largest of which measures 50 inches by 23.†

* The late Capt. Haines, in his Survey of the Arabian Coast, describes this singular hill much more in detail. Its height he estimated at 300 feet, with a table top, the centre of which is completely hollow, like the Devil's Punch-Bowl in Hampshire, and between two and three thousand yards in diameter, with a steep descent, having its lower surface covered with water, the depth of which, at eight yards distant from the western bank, was 66 feet.

† Supplementing Captain Miles's brief account of Hisn-Ghorâb, I may here state that the ruins were first discovered in 1834, during Captain Haines's survey of the coast, by Wellsted and Cruttenden, of the Indian Navy. The modern name signifies the Castle of the Crow, or raven, probably from its colour; or, perchance, as Wellsted intimates, "Ghorâb" was the designation of an Arab tribe. A tribe of that name still exists a little farther north. The locality has since been identified as the *Kanè* of the author of the 'Periplus,' and the *Cane Emporium* of Ptolemy—writers of the second century—who describe it as a great commercial

On the morning of the 10th the travellers were joined by the Deaybees and their camels. Their own party consisted of three followers and themselves; the escort numbered seven matchlocks of the Al Abdulla, the chief clan of the Deaybees, and one man sent by Sultan Hadi. At 2·15 P.M., continues Captain Miles, we mounted and commenced our journey, and, after passing two small wâdis, ascended a plateau from 300 to 400 feet high, composed apparently of limestone and clay, and, at 8·30, camped for the night in a hollow among the sand-hills.

By 4 A.M. of the 11th we were again on the move. Our road now lay over a sea of loose sand, dotted with bushes, and, here and there, a few *sumar*, *nabak*, and *sidr* trees. We also passed a belt of wild date-palms, laden with their small tasteless fruit, which is called here *Tamar el-Louz*. At 6 A.M. came to the village of Joweir —probably Wellsted's Ain Jowari, but it is much farther from the sea than he makes it—situated near a wooded and fragrant nullah. No game whatever is to be seen in these parts except, rarely, a gazelle or two. The feathered songsters, especially the crested lark, were, however, very numerous. At 8·20 we arrived at Ain Ba Mâbud, a small fishing-hamlet surrounded by a date-grove. Here many of the Bedouins came to see us, probably not having before seen a European. They endeavoured to pick a quarrel with our Deaybees for having brought us into their country; this was, however, partly out of jealousy, and a desire to share in what could be got out of us—the Bedouins looking upon a traveller, especially a European, as the coast tribes look upon a wreck, namely, as one of God's best gifts, to be made the most of. We saw some of the women here; they go about freely, and, like the generality of Bedouins, are coarse and ugly creatures, ornamented with beads and copper anklets.

At 6 P.M. we continued our journey over the sandy wilderness, and camped shortly after. Starting the following morning at 7·15, arrived at Soheil, a low hill, on the top of which was a spring, gushing out from a limestone basin, shaded by wild date and *sidr*

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mart, from which most of the frankincense grown in the adjacent country was exported. It traded with Baraguza, or Broach, Sind, 'Omân, and Persia, and was subject to a king who resided at Sabbatha (probably the modern Sanâ'â), some distance inland. The identification of Hisn-Ghorâb with Kanè is confirmed, as first pointed out by the late lamented Mons. Fresnel, by the occurrence of the word KaNA in one of the Himyaritic inscriptions found there, namely, that numbered 4 in Wellsted's, and the second of Captain Miles's transcripts, exhibited to the meeting. I have indicated the word by red lines. Captain Miles's copy of the large inscription has been made with great care, and will serve to remove some of the difficulties which Himyaritic scholars have encountered in deciphering and translating Wellsted's less perfect copy.—[G. P. BADGER.]

trees, and greatly resorted to by the feathered tribe. The heat was intense. Our Deaybee escort had by this time become very friendly with us. They were merry and talkative, but reticent regarding their country. They gloried in the name of Himyar, and boasted of their direct descent from that race, whose language they still retain. At 3·30 P.M. we were again on our camels, travelling due west; the country generally open and sandy, but cheerfully varied here and there with sterile, stony tracts. The hills are remarkable for the strong resemblance the crests bear to artificial fortresses. Camped for the night, at 7·30, in a hollow named Howeil el Arab. No water.

Resumed our journey at noon, our direction changing to N. and N.W. Trees were now numerous, and we soon came in sight of villages and cultivation. At 5 we reached the town of Reida; but our escort having a blood feud with the inhabitants we were obliged to pass it. Soon after, the fortress of Nakab el Hajar, situated on a commanding eminence on the right bank of the Wâdy-Maifah —here half a mile or more broad—appeared in view, and at 5.45, having obtained a guide and permission from the sheikh, we started at once to visit the ruins. These have been so ably described by our intelligent predecessor, Lieutenant Wellsted, that any attempt of the kind on my part would be needless. Well, however, as he has performed the task, I confess I was scarcely prepared for the real grandeur and extent of the place. Some of the blocks of stone are of enormous size; the beauty and exactness also of the masonry of the building at the south end excited our admiration. No mortar has been used, and, like the Etruscan walls of Italy, the outward front only has been smoothed. Though little more now remains than the dilapidated exterior wall, Maifah is a noble monument of the laborious vigour of a former age, and must in its palmy days have been an almost impregnable fortress, well calculated to be the emporium of that rich and extensive commerce between the East and West, of which the Wâdy-Maifah has been, from the earliest times, one of the principal channels, as the numerous remains at Kedoor, Eisan, Radêha, Hisn Ghorâb, and perchance others, testifying to the wealth of this part of the country and its large population, sufficiently show. Its former importance, too, is apparent enough from the designation given it by Ptolemy, with whose *Mœpha Metropolis* its identity may be considered as established. The inscription over the entrance was soon found and copied, as were also two others, almost illegible. We had been less fortunate than the former travellers in having come through a desert country, out of the line of the villages they passed through.

[I may here remark that Wellsted ascended the Wâdy-Maifah through the valley, and describes the country as well peopled and very fertile. By taking a different route Captain Miles has extended our knowledge of the adjacent district.—G. P. B.]

He proceeds to say: From the little we saw, the cultivation appeared to be excellent. The people at Nakab el Hajar were very civil and well disposed. The distance we had come from Ain Joweir was about 43 miles, and our elevation above the sea-level about 1500 feet. The town of Eisan was visible from Nakab el Hajar, lying about 6 miles to the N.W. It is said to be built within the ruined walls of a fortress, like Nakab el Hajar, but on a smaller scale. We did not hear of any inscriptions there.*

By 4 P.M., continues Captain Miles, we resumed our journey towards Hota. Passed on our right the village of Kail, picturesquely situated on the spur of a hill, and entered the stony bed of the Wâdy, in which are pools of water and extensive date-groves, and soon after came in sight of the suburban houses of the town. We had not proceeded far when we noticed the people gathering on the banks opposite. On our nearing them, they shouted out, "Who are you, and what do you want here?" "Khulk-Allah," (God's creatures), replied our escort. The answer was that they would not allow Kâfirs to set foot in their country, and at the same time a number rushed forward and stopped the camels. Suddenly a tall old man came forward, and adjured them in the name of God and the Prophet to be quiet, while he and other greybeards discussed what was to be done. Eventually it was decided that we should go

* I may here remark, by the way, that the Wâdy-Maifah is the most western of five great valleys on the southern and eastern coasts of Arabia which divide the mountain land into separate tracts, and afford passage into the interior. From its comparative nearness to Mâreb, the capital of the Himyaritic dynasty, there can be no doubt that the Wâdy-Maifah was much used, as a commercial route, in olden time. Captain Miles, following Fresnel, identifies it with the *Mæpha Metropolis* of Ptolemy, who places it, approximately, at the same distance from his *Cane Emporium* as Hisn-Ghorâb is from Nakb-el-Hájar. If any further proof of the identification were required, we have it in the fact, first pointed out by Fresnel, that the word "Maifat" occurs in the inscription, as given by Wellsted, over the entrance to Nakb-el-Hájar. In Captain Miles's transcript, which appears to have been taken with great care, I read "Maifa'at," with an *'ain*, and that, or its equivalent "Maifa'ah," may be the correct modern Arabic name.

The inscription, as I read Captain Miles's copy, is simply the genealogy on the male and female side, of one Yabsal, the son of Shéjeb-Katdam (or Katd), of the children of the family of Maifa'at-Ghalfath, who probably either erected or restored the building. We glean one important fact, however, from the inscription, viz., that towns and districts in that country (such as Shéjeb and Maifa'at) continued to be called by the names of heads of tribes, in the same way that the names of Uzal and Sheba, sons of Joktan, continued for ages to be applied to their later representatives, Sana'â and Mâreb, and that of their brother, Hazarmaveth, to the territory still called after him "Hadhramaut."—[G. P. B.]

on to Hota and obtain the sheikh's orders on the subject. Our Deaybees behaved admirably, and were evidently prepared to fight for us. Pursuing our path through the thickly-planted date-trees for about two miles, we reached the inner extremity of the town.

It was now quite dark, and we were totally at a loss what to do. At this juncture we received a message from the sheikh to say that we were welcome, and should have his protection. As we were preparing to make the best of it, we heard that Salih Ahmed, the son of the Sultan of Habban, was in the town. Sallâh, our factotum, was dispatched to him at once; and before long he came and conducted us to his house. Here, after ascending the narrow dark stairs for six or seven stories, we were shown into one of the snug little partitions on the roof, where we took up our quarters for the night. Early next morning we descended to the *Kahwah*, or reception room, and were plagued the whole day by an unbroken succession of visitors; the women, too, with the curiosity of their sex, peered at us through the windows of the adjoining houses. Our host's hospitality did not extend even to a cup of coffee, and we had the greatest difficulty in procuring supplies, for which the most exorbitant prices were demanded.

Our Deaybee friends took their departure to-day, much to our regret, for they had behaved exceedingly well. We tried in vain to induce them to take us on to Habban, whither we were obliged to send for an escort from the Bedouins on the road.

Friday, 15*th*. We were much better treated to-day, but still annoyed by the intrusion of visitors. They examined our things with much curiosity, and a Snider rifle was a source of their boundless astonishment and admiration. Their ignorance was amusing: one asked whether we ate sheep, fowls, &c., mistaking us probably for Banyans. Another seemed to believe that the Sultan of Lahej [a petty chief near Aden] and the Sultan of Turkey were one and the same person. We were told that there were numerous inscriptions at Habban, and also at Kail close by; but on reference to the sheikh he said there were only the ruins of an aqueduct on the hill. The ruins at Kedoor were described to us as being as extensive as those at Nakab el Hajar, from which they lie about 10 miles distant, to the west. An answer arrived this evening from the Sultan of Habban inviting us there, and with it an escort of Bedouins; but as they were of use only for the latter part of the journey we had to obtain others from the sheikh.

The next day, *Saturday*, left Hota at 3 P.M. Our route lay west, along the bed of the Wâdy Amageen. After 5 miles, we came upon some Himyarite inscriptions, cut in the sandstone rock forming

the bank, which we copied; and a mile farther on we passed a large nullah to our right, named Selmân, on which we heard was the town of Randa, inhabited by Haik, an outcast and despised race. Following a nullah over the hills, we arrived at Radêha, on the Gheit Habban stream. We did not halt at the village, which was populous and surrounded with cultivation, but waded up the strong current two miles farther, and camped for the night under the shelter of a sandstone cliff. The stream is perpetual, fed by numerous springs, and with its border of reeds, fragrant shrubs, and tall palms, was by far the most interesting spot we had yet seen.

Sunday, 17*th*. Resumed our journey at 4 A.M. up the nullah, passing a few villages, beyond one of which, Laheea, we camped at 6 under a large *nabak* tree. The chief of Kedoor came to visit us during our halt, and invited us to visit him. He described the ruins of Kedoor as very extensive, but he had not noticed any inscriptions on them. Kedoor is about 6 miles from Laheea. We heard here of the remains at Radêha, which we had passed in the night; the accounts of the place leave little doubt of there being inscriptions there. Radêha is probably another of the fortified depôts or stations on the great caravan route between Kanè (Hisn-Ghorâb) and the north.*

Started again at noon, travelling still in the sandy bed of the nullah. Here we came across some Himyaritic, Hebrew, and Arabic inscriptions, cut in the sandstone bank, the smooth surface of which has offered a tempting field for both ancient and modern scribblers. The country now begins to open out into an extensive plain, containing many Bedouin houses, the inhabitants of which treated us very civilly, saying they wanted no Kâfir dogs among them, and promised most kindly to hang with one rope the next batch of Christians that came that way.

On approaching Habban we were met by a party of the Sultan's men, who escorted us to the town with a *metâfah*, or procession, and conducted us, under a heavy fire from an old Turkish cannon half-buried in the mud in the palace courtyard, to the *Kahwah*, where we had *kishr* [a decoction of coffee-husk, flavoured with cardamums and other spices], compliments, and conversation until we retired.

On the morning of the 18th we visited the inscriptions at Shejeb, a place belonging to the Bedouins, but beyond the Sultan's jurisdic-

* On referring to Ptolemy, I find that he places a *Rhæda* in long. 83° 20', lat. 14° 10'; his *Mæpha Metropolis* he places in long. 83° 15', lat. 15°. The fact that these are approximately the relative positions of the modern Radêha and Nakb-el-Hâjar strongly confirms Captain Miles's conjecture.—[G. P. B.]

tion, although within a few hundred yards of the town. On the way we passed through a subterranean passage, called Nakab el Kureef, about 150 yards long and 7 feet high, apparently excavated artificially, for bringing water from the nullah for storeage. Shejeb we found to be a low, flat hill, in which sandstone greatly predominates. The inscriptions are on both banks of the nullahs, and are very numerous. They are mostly Hebrew, very roughly and not very legibly cut. The Himyaritic are still more irregularly carved, and are interspersed with Hebrew characters.

Visited Shaab next day, but found there only one short Hebrew inscription and a few Himyaritic letters. We were then taken to Keltna, a high sandstone rock; but here there was only one Himyaritic word, at which we were greatly disappointed, as this was our last hope of finding any more on our journey.

Wednesday, 20th.—We have been compelled, through pressure of time, to relinquish the idea of pushing on to Nisab and Datheena. There has been great difficulty in procuring camels from the Bedouins; but Shereef Ali, one of the most influential men at Habban, has offered his own as far as Monjaa, and proposes to accompany us himself.*

Thursday, 21st.—Left Habban at 8 A.M., travelling in a southerly direction, over a broken country which we were obliged to cross partly on foot, then over the hill range dividing the Wahidee and Owlaki tribes, descending by a precipitous nullah into the Valley of Khubr. Here we were fired on and stopped by a party of Bedouins; but the presence of Shereef Ali restrained them from further molesting us, and, following the Wâdy over a plain dotted with low hills, arrived at Khubr at 9 P.M. Khubr is a town of the Gûmûsh, a sub-tribe of the Owâlik, situated in a gravelly plain cut up by nullahs. There are several date-groves and a good deal of cultivation about, the alluvial soil yielding abundant crops. We here sent back our Habban escort of four men, taking on five of the Gûmûsh instead.

Friday, 22nd.—Left Khubr at 6·30 A.M., direction south-west, along the nullah and then over a barren desolate country, and at noon arrived at Mahfuz, a town of the Shimai tribe, where we were received very civilly by the chief. Mahfuz consists of fifty or sixty houses, with the chief's, or "Âkil's," house, built, as usual, on a small eminence close by. It is situated in an extensive plain, called Monjaah; the whole of it is under cultivation. Shereef Ali

* Captain Miles's journal and Mr. Munzinger's sketch-map enable us to correct the positions of Habbân (or 'Abbân), Eisân, and Nisâb, as laid down conjecturally in our maps of Arabia.—[G. P. B.]

here sent his camels back to Habban, procuring others for us from the Shimai. He wished us to give twenty dollars to the five men we had brought from Khubr this morning, and another present to some Bedouins who had followed us, but we refused. These fellows had endeavoured to levy blackmail from us on the road; and one pugnacious youth, with a hatchet in his girdle, had thrown a big stone at our heads to show his manliness.

Sunday, 24th.—We did not get off from Mahfuz till 3 P.M. Our route was among the hills down the pleasant Wâdy Howr, which is generally well wooded. Put up for the night at a watering-place called Nejed, and starting next morning at 4 o'clock came up with excellent water at 9·30, at El-Kuliya, where we halted. Our escort is the best we have had since we parted with the Deaybees. Left Kuliya at 3·45 P.M., and continued our course down the Wâdy. Passed several springs, and at 6 P.M. camped at a spot called Soheb. Some of the Bedouins we met to-day took up stones to throw at us; they were miserable-looking creatures, and were easily satisfied with a little coffee and grain. They manage with great difficulty to eke out a bare subsistence from their flocks and toddy-trees. They are all Ba-kâzim. Leaving Soheb at 8·30 we had a fatiguing march of 7½ hours; the night was dark, and we could see nothing of the country. Our road, after quitting the Wady Howr, led over a hilly district intersected by nullahs. At 10 P.M. we came to an encampment of the Ba-kâzim, who entertained the Shereef. The water at this place, which is called El-Akhther, was foul and fetid. Troops of baboons were here howling and barking all around us. To-day we wrote to Sultan Abu Bakr, at Howr, excusing ourselves from paying him a visit.

Tuesday, 26th.—Started at 2·45, and in three hours passed a huge mass of sandstone, whereon we found numerous Himyaritic scribblings; some of the letters were very large, and of a peculiar form. The strip of plain which we now traversed, between the sea and the hills, which have been gradually decreasing in size since we left Habban, averages betweeen 8 and 10 miles. Camped among sand-hills at 7·30, near a place called Mathuf. Distance, 14 miles.

Wednesday, 27th.—From 5 A.M. to 11 A.M. over an undulating country; general direction south-west. Found excellent water at Ba-Subbahi, under the shade of a spreading mimosa. About an hour after our arrival we were surprised by the appearance of Sultan Abu Bekr, who had come in person from Howr to urge us to pay him a visit. He told us of some ancient ruins, and a very deep well dug through the solid rock, at Mathuf, close to the place where we had slept. Resuming our journey at 4 P.M., we camped, after a

short stage of 2·40 hours along the sea shore, among the sand-hills. A ride of 5¼ hours the following day brought us to Bir-Merwan, where there is good water. On again in the afternoon for another 5¼ hours, one half-hour past the hamlets of Kubr and Koheir, the boundary between the Owlaki and Foodhli territories, where there is a little cultivation. The well at Khubr is within 20 yards of the sea, yet the water is perfectly sweet. From 3·45 A.M. to 8·45 A.M. of the following day the route ran along the sea-shore, passing the Wady Sennif half-way. Halted at a place opposite Sureea, the chief residence of Haidera, the Sultan of the Foodhlis, who gave us a friendly reception and entertained all our people. He told us of some ruins at Serrer, which he described as a tower on the top of a conical hill. Resumed our journey in the afternoon for three hours, and camped for the night among the sand-hills. In 4 hours' ride the following day arrived at Shugra, a growing town and bunder, 24 miles distant from Surreea. This place was occupied by our troops in 1866, when the house of the present Sultan's predecessor was destroyed. It is being rebuilt. We were now in the beautiful and fertile district of Abien, and having nothing to detain us we pushed on and arrived next morning at Aden.

The Rev. G. P. Badger made the following remarks on the Paper:—

The southern and eastern portions of the great Arabian peninsula are generally believed to have been peopled by the descendants of Joktan, the son of Heber, the son of Shem, "whose dwelling," as we read in the 30th verse of the tenth chapter of Genesis, "was from Mesha, as thou goest unto Sephar, a mount of the East." Now, although it is not absolutely certain that Sephar designates Zhafâr, near Râs-Sájar, the largest cape on the south-east coast of Arabia, nevertheless those parts of the country which were once, or are still, styled Ausâl, Sába, and Hadhramaut, recall so precisely the names of *Uzal*, *Sheba*, and *Hazarmaveth*, three of the sons of Joktan, as to place it beyond doubt that the southern parts of Arabia were the primitive residence of the Joktanites.

Arabian authors identify Joktan with Kahtân, the third in descent from whom they make 'Abd-Shams-Sába, who was succeeded by his son Himyar, so called, it is said, because he affected red garments. Himyar is the head of the great Himyaritic family, styled "Homerite" by Greek and Latin authors. It occurs for the first time under that name in the account of the expedition of Ælius Gallus into Arabia, about twenty-four years before Christ. The family reigned in Yemen from the time of Himyar to the conquest of that country by the Abyssinians, A.D. 525, an interval of about twelve centuries, divisable into two periods. During the former the descendants of Himyar shared the sovereignty with other families, chiefly of the same stock, namely, that of Kahtân. These several princes and their subjects continued to be designated "Sabeans"—as being the issue of Sába, or Shaba, the son of Joktan—for a long time the only title by which they were known to foreign nations. It existed up to the date when the supreme power was concentrated in the house of Himyar. With this began the second period, during which the dynasty of

Himyar flourished in unrivalled splendour, and the name of "Himyarites," or "Homerites," began to replace that of "Sabeans." This second period is that of the "Tobba," a word commonly supposed to mean a successor, equivalent to the *Khalifah* of the Muslim dynasties.

The cities which were successively the residence of the Tobbas were Mâreb or Sába, Zhafâr (in Yémen), and Ausâl or Sanâ'â. Hadhramaut, according to Ibn-Khaldûn, was governed by its own chiefs, who were sometimes vassals, and sometimes independent of the Himyar sovereigns. It is to be presumed that Hadhramaut passed under the Abyssinian yoke at the same time as Yemen. Thenceforward the Hádhramy race began to lose its distinctive existence, retaining however, as it does to the present day, a peculiar dialect.

All writers, sacred and profane, speak of the wealth and prosperity of the Sabæans or Himyarites. Agatharcidas describes the country, nearly two centuries before the Christian era, as abounding in every production that could make life happy: the trees wept odorous gums, and the gales were so excessively fragrant that the natives were obliged to renew their cloyed sense of pleasure by burning pitch and goat's hair under their noses. Their houses were decorated with pillars glistening with gold and silver, and the interior of their habitations corresponded with their outward appearance. Strabo, in the first century, states that their mountains produced gold in vast quantities, and in lumps from the size of an olive to that of a nut. (What an exodus from this country there would be if any such mines were discovered in Arabia now!) And the author of the 'Periplus,' nearly two hundred years later, confirms in the main these accounts of the riches of the Himyarites. Their principal occupation was commerce, to which they owed most of their wealth and fame. That the Arabs were the first navigators of their own seas, and the first carriers of Oriental produce, is evident from all history. Sába, Hadhramaut, and 'Omân were the residence of merchants from the very dawn of civilization. They had frequented the ports of the Red Sea, crossed the Persian Gulf, and visited the coasts of India long before those regions were known to the nations of Europe. Ptolemy and the author of the 'Periplus' furnish us with detailed lists of the exports and imports of the country, and the various articles of the transit trade; also with the names of the numerous commercial emporiums on the coast, and of the inland stations with which they were connected, showing that up to the second century of our era the Himyarites were still a flourishing people and the principal carriers of the Eastern produce, which eventually found its way by different routes to distant Asiatic countries, to Egypt, and to Europe. The overthrow of the native dynasty by the Abyssinians in the sixth century, the rise of Islâm in the seventh, the subsequent removal of the Khalifate to Baghdâd, and the discovery of the passage round the Cape of Good Hope, together with almost uninterrupted intestine anarchy, were among the principal causes which diverted the trade from Southern and Eastern Arabia, reduced its people to poverty, and split them up into a number of petty chiefdoms, the miserable representatives now of the ancient Himyaritic sovereignties.

Considering the conspicuous part which those sovereignties played in the history and commerce of the East, it is surprising that the territory which they inhabited should have attracted so little modern research. Thanks to the liberality of the old East India Company and to the admirable surveys of the late Indian Navy, we are well acquainted with the geography of the coast; but comparatively little has been done to open out the interior, insomuch that very many places mentioned by Strabo, Ptolemy, and other ancient writers, are still a riddle to us. Yémen, owing to its importance as a separate state under the Imâms of Sanâ'â, who for a long period held possession of the ports of Mokha and Aden, has been the most favoured by European travellers. Among those who have contributed to our stock of knowledge respecting

Yémen, I must not overlook Ludovico di Varthema, in the early part of the sixteenth century, whose interesting narrative, however, was eclipsed a hundred years ago by the scientific and painstaking Carsten Niebuhr, who collected a vast amount of valuable information respecting the country, the people, and their government. Sanä'â was also reached by Cruttenden, of the late Indian Navy, in 1836, from whence he brought several Himyaritic inscriptions, and also by Mons. Arnaud, in 1843, who extended his travels to Mâreb, examined the famous dyke there, and succeeded in adding largely to our slender stock of ancient Himyaritic inscriptions. The few other Europeans who have visited Sanä'â in modern times—they may be counted on one's fingers—have contributed nothing towards the history or comparative geography of Yemen.

Of the country 20 miles beyond the Aden fortifications we know scarcely anything, except what ancient history and the Arab traders tell us. The next place from whence any attempt has been made to penetrate into the interior is Bîr-'Aly, 250 miles from Aden, where in 1834 Wellsted and Cruttenden discovered Hisn-Ghorâb, and then proceeded up as far as Nakb-el-Hájar, through the Wâdi-Maifah. In 1843 Baron de Wrède extended his researches about 120 miles to the north-east and north of Nakb-el-Hájar, and explored the Wâdi-Dau'ân (written "Doan" in Mr. George Walker's comprehensive map of Arabia), which the late eminent Orientalist, M. Fresnel, satisfactorily identified with the *Toani* of Pliny, who, in the 6th Book of his 'Historia Naturalis,' enumerates them together with the *Chatramotites* (that is, the Hadhramautis) and the Sabæans. According to the same author, whose testimony is corroborated by Strabo and Ptolemy, the country of the Toani was most fertile, abounding in palms and flocks, and inhabited by a brave and warlike race. The description holds good of the valley of Dau'ân at the present day: Baron de Wrède counted no less than five towns and three villages within an hour's march, and the military prowess of the people is still proved by the fact that many of them emigrate to India in order to take service with the Mussulman independent princes.

The Baron succeeded in reaching the town of "Sava," from whence a day's journey brought him to the great desert of El-Ah-kâf, there called Bahr-es-Sâfy, or the Pure Sea, or Abyss, which he describes as being 1000 feet below the level of the high land. The sand consisted of an impalpable powder, and on throwing a plumb-line measuring 60 fathoms into it, the cord sank instantly, and in five minutes disappeared in the all-devouring tomb. This abyss of land is undoubtedly one of the most singular phenomena on the earth's surface.

Among the valuable additions to science made by Baron de Wrède was a map of Dau'ân and some of the contiguous valleys; a list of Himyaritic kings, which serves to fill up the lacunæ of the dynasty, as given by Abulféda, Nowairy, and Hamza of Ispahan; and a large Himyaritic inscription, containing many names of places, including the word "Hadhramaut."

Higher up on the coast, 130 miles to the north-east of Hisn-Ghorâb, is Gossier, according to Capt. Haines a town of about 300 inhabitants, nearly all of the Beit-'Aly and Beit-Ghorâb tribes. From this point Dr. Hutton and Mr. Smith, of the surveying-ship *Palinurus*, made a short excursion inland, which in Mr. Walker's map is erroneously attributed to Cruttenden. The same officers, accompanied by Lieut. Saunders, made another trip inland from Misânah, an antique ruin, situated some 20 miles to the north-east of Gossier. As far as I know, the only account of these trips which we possess is contained in a short paper, read before the Bombay branch of the Royal Asiatic Society in February, 1837. Two or three dilapidated forts of ancient construction were examined, of which the natives could give no other account than that they had been built by the Franjis. On both occasions, however, many Himyaritic inscriptions were discovered and copied; but as they had been

executed in red paint, most of them were rather imperfect or illegible. About the same period Cruttenden accomplished his trip along the shore from Marbât to "Dyreez," one of the principal towns of Zhafâr, a distance of 40 miles.

The foregoing, briefly stated, is all that we know of the interior of Hadhramaut. 'Omân, to the northward of that region, was not included within the Himyaritic dominions, although its original settlers belonged to the same stock. We are indebted for almost all our knowledge of the geography of that province to the late Lieut. Wellsted, of the Indian Navy, who travelled through a part of the interior thirty-five years ago. The Hakluyt Society has just published an elaborate history of the Imâms and Seyyids of 'Omân, translated from the Arabic, accompanied by a revised map of the country and the littoral of the Persian Gulf, which will add considerably to our knowledge of the topography of those regions and of the civil, religious, and domestic institutions of the 'Omânis.

I shall conclude these observations with a few words on the Himyaritic character.

Until within the last thirty-five or forty years very little was known of this style of writing, which has been disused since the time of Muhammad. It is called "Musnad," that is, supported or upright, by late Arabian authors, who, however, held very contradictory opinions about it, some affirming that all the letters were conjoined, others that they were isolated, and others again that the *Musnad* was read from left to right. If I mistake not, the first inscription was discovered by Wellsted and Cruttenden at Hisn-Ghorâb in 1834, and recopied, as we have seen, by Captain Miles. Since that time others have been brought from Sanâ'â, Mâreb, and the valley of the Dau'ân, by Cruttenden, Arnaud, and De Wrède, and a great addition was made to them in 1863, consisting of a number of copper-plates, evidently intended originally to be affixed to walls, brought from the neighbourhood of Sanâ'â, and presented to the British Museum by Sir William Coghlan. A copy of these unique plates lies on the table. I understand that several fresh inscriptions have lately been brought to this country from Aden.

In shape the letters resemble the Ghîz or ancient Ethiopic more than any other alphabet. The language is undoubtedly Semitic, belonging to the same family as the Hebrew, Chaldaic, Syriac, Aramaic, Arabic, and Ethiopic; and Sir Henry Rawlinson will correct me if I erroneously include many of the cuneiform inscriptions in the same category. In its grammatical construction, its inflections and suffixes, it follows the Syriac rather than the modern Arabic, and is generally read from right to left, though occasionally in the style called *Boustrophédon*, *i. e.* continuously from right to left and from left to right, and the words are separated by a vertical stroke. Gesenius, Roediger, and Fresnel were among the first to pursue the study of the Himyaritic. Considerable progress has since been made in deciphering these monuments, which all date prior to the seventh century. Fresnel, as far back as 1843, recognized in them the names of several Himyaritic kings, and identified Ashtaroth, Astarte, or Venus, as having been worshipped by the Himyarites under the title of "Athtar." The inscriptions mostly refer to votive offerings and the conveyance of land, with invocations against infractions of the agreements concluded. The occurrence on the tablets of the ancient names of places has facilitated their identification, and thereby thrown new light on the comparative geography of those districts. Captain Miles mentions in his journal that the Deaybee tribe, who claim descent from Himyar, speak a peculiar dialect, and the Mahrah tribes on the north of Hadhramaut have a language of their own. Dr. Carter, formerly of the Bombay medical service, besides supplementing the labours of Dr. Vincent by his treatise on the comparative geography of this part of Arabia, and by his valuable notes on the geology of the coast, also collected a short vocabulary of the Mahrah. Further researches in those

districts will probably remove all philological difficulties in the way of a perfect translation of the Himyaritic inscriptions.

Appended to Captain Miles's narrative is a description of the principal tribes inhabiting the country traversed, namely, the Wahîdy, the Deayby, the 'Olaky, and the Fudhly, particularising their subdivisions, boundaries, probable numbers, government, domestic institutions, habits, and occupations; also the various produce of their respective territories. Not the least interesting fact brought to our notice is the existence of Jews in those out-of-the-way localities. "They have been here," writes Captain Miles, "beyond tradition," and he mentions Habbân as one of their principal colonies. "Though very industrious they are wretchedly poor, and are not allowed to own any part of the soil. They are chiefly artisans, journeymen, gold and silversmiths, &c. The women rear great quantities of poultry." Captain Miles's is undoubtedly the fullest account which we possess of the people of those hitherto little known regions.

Accompanying the narrative is an able paper by Mr. Munzinger,—the gentleman who did good service for us in Abyssinia,—on the geographical features, the geology and hydrology of the triangle between 'Ain-Juwair, Habbân, and Howr, illustrated by diagrams. The country, he says, presents two distinct geological regions—the sand-and-lime and the metamorphic; the former having its west frontier near Habbân, and running in a south-easterly direction, and the latter leaning against it from the west, and extending south-east and south-west, its waters flowing principally northward. The sand-and-lime region forms a plane, nearly filled up with a double range of hills; one consisting of inaccessible blocks, or Ambas, from 1500 to 2000 feet high, and the other from 300 to 500, and covering nearly eight-tenths of the entire space, without, however, forming a continuous ridge. The rocky character of these hills excludes all idea of vegetation or animal life: they influence the country only by sending water, sand, and lime to the plain. The metamorphic region consists of a disorderly agglomeration of hills, all connected together, forming a mountainous country—not a plateau—seldom interrupted by plains or nullahs. The rock is gneiss, slate, and quartz, in curved strata, often indicating extraordinary pressure. Water in both regions lies generally from 50 to 100 feet under the sand-bed, and is found in large quantities. Running water is only found where underlying rocks or cataracts force it up to the surface. An extraordinary exception to the general rules are the artesian sources, as they may be called, at 'Ain-Juwair, Soheil, and other localities, where out of a sandy plain, lying near limestone hills, rise hillocks 50 feet high with lively sources. As these hills are too small to account for the presence of such springs, we can only suppose that they come from the neighbouring hills through natural pipes. Mr. Munzinger remarks by the way that it is a great mistake in our cartographers to colour African and Arabian nullahs blue, as if they were rivers full of running water.

But it would be doing Mr. Munzinger an injustice to attempt to condense his paper, which must be read entire and carefully studied in order to be properly appreciated. I may mention, however, that he has also supplied detailed memoranda of elevations, directions, and distances, from which a tolerably accurate map may be constructed. Mr. Munzinger, whose ardour in the cause of science needs no eulogium from me, regrets that the British Government takes so little interest in antiquarian and other researches, and thinks that while we spend so many lacs of rupees on forts at Aden, which he says are not always *très réussis*, we might spare a little money in the exploration of Arabia and Somâli land (Mr. Munzinger has evidently no idea of the impecuniosity of our Government). While cordially agreeing with him on this point, I hesitate to second his suggestion for combining sanitary, military, political, and geographical views, namely, that half the Aden garrison should

be marched out for three months in the year for a promenade in the hills—once to Ta'ezz, once to the coffee-hills of the Yâfa'iy, once to Nisâb, and so forth, paying for everything, and demanding nothing but respect. I have no doubt that the troops would enjoy it amazingly: I am sure I should, when I was at Aden; but, as we have seen from Captain Miles's narrative, the Arabs in that region have a nasty habit of stoning and practising other amenities upon strangers,—a mode of salutation which I fancy British soldiers would feel themselves bound to reciprocate otherwise than by giving them doles of coffee and grain; and then? Why, then we should be involved in petty wars, and the slow but sure process of removing the prejudices of the Arabs, which is quietly going on through trade and friendly intercourse between Aden and the adjacent tribes, would be arrested for years. On the other hand, however, every lover of science will coincide in the sentiment with which Captain Miles concludes his interesting paper:—"I trust, with Mr. Munzinger, that some one may be induced to explore this region thoroughly, and bring to light its long concealed mysteries; for it seems inexplicable, in this age of discovery, that a country so remarkable, so interesting from its historical associations and antiquarian wealth, should attract so little notice."

The CHAIRMAN said that very little was really known of the interior of Southern Arabia, yet the country was full of interest. Hitherto travellers had merely probed the sea coast, going up the "wadys" or dry valleys stretching inwards, but the really fine country was to be found on the plateau above. Sanâ'â and Mareb were very productive countries, and no doubt a high degree of civilization existed there from very early times. Whether the Queen of Sheba came from Sanâ'â or from Saba it was impossible to say, but she certainly was the Queen of Southern Arabia; and it was a very remarkable thing that throughout all antiquity these Arabians were found to be frequently governed by queens, being the only civilized nation of antiquity who had this peculiarity. Thus throughout the writings of the Assyrians, wherever the Arabs were mentioned they appeared as governed by queens. In the wars of Sargon there was an account of a contest between the Assyrians and the Egyptians on the coast of Arabia; and the Sabæans, who were allies of the Egyptians, took the field under their queen. In the annals of Tiglath-Pileser the Arabs were also subject to a queen. In the seventh century before our era, Sardanapalus led an expedition into Arabia, and carried on a long campaign against the tribes there, having probably penetrated as far as Mecca; and in a list of the chiefs whom he subdued, half are given as queens and half as kings. In the whole course of Eastern history, as preserved to us in the writings of the Babylonians, the Assyrians, the Medes and Persians, there is no other instance of a nation being governed by queens; and thus profane history affords a singular corroboration of sacred writ, the Queen of Sheba being the only queen we have a record of in the Bible. As to the Himyaritic inscriptions, they afford a large and interesting field of enquiry. They are found by hundreds, and not only on rocks, but on copper plates, which are indeed met with wherever excavations are carried on. A few years ago, Sir William Coghlan sent sixty or seventy of these plates to the British Museum. Captain Miles had also sent over some, as well as a piece of alabaster with the figure of a man, and his name and genealogy. Generally there was very little interesting matter in these inscriptions. They were almost always dedications of votive offerings; or else a mere personal memorial something equivalent to the modern photograph, at the head and foot of the engraving the names of the person and of his parents being generally put. On some of the larger inscriptions however there were dates, and it thus became of interest to ascertain what these dates referred to. This subject had been investigated by many French and German savans, but no positive conclusion had been arrived at. Bunsen long ago suggested that the Arabs dated their era from the first bursting of the great dyke at Mareb.

There were formerly in Southern Arabia two works which were considered amongst the wonders of the world. One was a famous temple, the *Ghamdan* of Sanä'â, and the other was a dyke or embankment of stone at Mareb. This latter, in very early times, burst and devastated the whole of the lower country, becoming in consequence a famous epoch in Arab history, and it was supposed by Bunsen that the inscriptions dated from it. He put that event at about 800 B.C. This era was confounded by the Arab traditionists with the "era of Lokmán." The second bursting of the dyke at Mareb took place shortly before the time of Mohammed. The latest inscriptions were about 650; so that, if Bunsen's supposition were correct, the second century before Christ would be indicated. That date, however, was now generally considered rather too early. The best proof of the antiquity of the Himyaritic writings, was that on some of the cylinders of Babylon and Nineveh, which certainly belonged, at the latest, to the seventh century B.C., Himyaritic inscriptions were found; and although the antiquaries of the British Museum had hazarded the opinion that the legends were engraved at a later date, he could not see that there was the slightest argument in favour of that view. He maintained that the engraving of the legends was of the same date as the carving of the inscriptions. One of these cylinders was obtained by Captain Felix Jones at Annah, and was now in the British Museum, the Himyaritic writing upon it being certainly as early as 650 B.C. The specimens then on the table dated probably from the second and first centuries B.C. The inscriptions furnished considerable information regarding the religion of the Himyarites, the names of the gods being frequently mentioned. Some notion of the agriculture of the nation also might be obtained from them, but very little had hitherto been learnt from them about the trade. The Greek authors, however, proved that an extensive trade was carried on with Southern Arabia. The peacocks, monkeys, and gold that Solomon obtained probably came from Southern Arabia, and a book called 'The Periplus,' which contained an account of Eastern commerce, was filled with details of the productions of Southern Arabia. Although gold might not be so plentiful as it was, yet very valuable gums were still procured there, such as frankincense and myrrh; and Mocha coffee and many other products, also, were brought from the country in considerable quantities.

Fourteenth Meeting, June 26th, 1871.

MAJOR-GENERAL SIR HENRY C. RAWLINSON, K.C.B., PRESIDENT, in the Chair.

PRESENTATION.—*F. G. Horne, Esq.*

ELECTIONS.—*Thos. Brassey, Esq.*, M.P.; *T. B. Baker, Esq.*, C.B.; *D. Chinery, Esq.* (Consul-General for Liberia); *Commander Charles D. Inglis*, R.N.; *Wm. Chas. Jackson, Esq.*; *Geo. Wyndham Kennion, Esq.*; *Alfred Morrison, Esq.*; *Wm. G. Margetts, Esq.*; *Col. R. Maclagan*, R.E.; *Capt. G. S. Nares*, R.N.; *James Rickards, Esq.*

ACCESSIONS TO LIBRARY FROM 12TH JUNE TO 26TH JUNE.—'Travels of a Pioneer of Commerce overland from China towards India.' By T. T. Cooper. 1871. Purchased. 'Marco Polo.' By Colonel Henry

Yule. 2 vols. 1871. Purchased. 'The Financial Administration of India.' By Dadabhai Naorji. 1871. Donor the author. 'On Barometric Differences and Fluctuations.' By J. K. Laughton. May, 1871. Donor the author. 'Reisen in Ost-Afrika.' By Baron C. C. von der Decken. 2nd vol. 1871. Purchased.

ACCESSIONS TO MAP-ROOM SINCE THE LAST MEETING OF 12TH JUNE.—A Tracing of the Old Calabar River. By Capt. J. B. Walker. Presented by the author. Plans of the Scinde Railway. By J. W. Barns, F.G.S.

Before the commencement of the ordinary Proceedings, the PRESIDENT stated that this being the last meeting of the Session, it was his pleasing duty to ask the Fellows of the Society to join with the Council in returning their best thanks to the Chancellor and Senate of the University of London for the use of the noble Hall in which the meetings of the Session since Christmas had been held. He was sure the Fellows of the Society generally would recognise the liberality and public spirit of the Governing Body of the University in granting them this privilege.

The vote of thanks was carried by acclamation.

The President then announced that the Council proposed to continue the offer of Prize Medals to the chief Public Schools of the United Kingdom for the year 1872, and that the special subject chosen, both for the Political and Physical divisions, was South America.

He also drew the attention of the Fellows to the list of subscriptions towards procuring a *replica* of a bust of Sir Roderick Murchison, executed by Weekes, which was to be placed in the hall of the new building in Savile Row. The subscriptions were limited to one guinea each.

The following was then read:—

Sir Roderick Murchison communicated that he had received a letter from Dr. Kirk, dated 30th April, 1871, in which he stated that although no one at Zanzibar had been to Manemeh (the place where Dr. Livingstone was last heard of), he had ascertained that it was about a month's journey, say 200 or 300 miles, west of Tanganyika, and is a thriving ivory mart.

Dr. Kirk is of opinion that Livingstone had been led thither to examine a western lake he had heard of, and into which the waters from Cazembe flowed, and to ascertain whether they go to the west and the Congo, or to the north and Nile basin. He further hopes that if Livingstone should have settled the outflow of the Tanganyika, he will be satisfied, and leave all the rest of the work to future travellers, seeing that he has been out upwards of five years, and must sorely want rest.

It is satisfactory to know that abundant supplies are waiting for the Doctor at Ujiji on his return.

Dr. Kirk adds, that as the rains will soon be over, he can send any letters or parcels to Ujiji in about a month, that is about the 1st of June.

The President said he found some difficulty in believing that there was an interval of nearly 300 miles between Manakoso and Lake Tanganyika. The letter received from Livingstone by the Arabs in charge of his stores at Ujiji was only twenty-five days in transit. Now the average rate of travelling in those countries was only 10 miles a day; so that, judging from the time occupied by the transit of the letters, there could only be an interval of 250 miles between Ujiji and Manokoso, including the passage of the lake. It was, moreover, satisfactory to find that Livingstone was not stationed in an unknown cannibal territory, as had been supposed, but in a thriving ivory mart, between which and the sea-coast there was a constant trade communication.

The following communications were read:—

1. *Letters from* Dr. J. D. HOOKER, *on his Ascent of the Atlas Mountains.*[*]

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2. *On the Himalayan Valleys:—Kooloo, Lahoul, and Spiti.* By Captain A. F. P. HARCOURT, Bengal Staff Corps.

[EXTRACTS.]

THE particular Himalayan valleys of Kooloo, Lahoul, and Spiti, covering an area of over 6000 square miles, and containing close on 100,000 inhabitants, form a portion of the Kangra district, one of the thirty-two into which the Punjab is divided, and lie on the north-east frontier of that province, being bounded on the east by Ladakh, in the possession of the Maharajah of Cashmere, and below that again by Chinese Thibet. It is thus the extreme limit of our dominions towards Central Asia; the name Kooloo, I may add, being a corruption of the old term Koolunt Peeth, "the end of the inhabited world," which it always was considered to be by the Hindoos of the Plains.

The main Central Asian trade-route winds its way through the districts of Kooloo and Lahoul towards Ladakh and Yarkund. But if, geographically and commercially, Kooloo is deserving of attention, it possesses other claims to our recognition. Its climate, varying considerably, is totally unlike anything to be found in the Punjab, and probably in India. Its inhabitants, their customs, languages, and costumes, have each and all their special peculiarities; its scenery—here so soft and bewitchingly beautiful, and but a few

[*] These letters were published in the *Additional Notices*. See 'Proceedings,' vol. xv., No. 2, p. 212.

miles further on so stern and rugged—is certainly unmatchable elsewhere in Hindostan; and the religious belief of its people presents but few points of affinity with the creeds that are followed in other portions of our dominions in the East.

In the Punjab the winters, as a rule, are cold, temperate, and bracing, while the heats in summer are nearly unendurable, and the rainy season is moist and most disagreeably hot, except towards the south-west portion of the province, where the fall averages but 3 or 4 inches in the year. Then the various races that inhabit the Punjab present no very great dissimilarities in physique, feature, costume, or language; and though the Hindoos, the Mahomedans, and the Sikhs (these last being only 2 millions of the 19,000,000 who inhabited the Punjab in the census of 1867), have all their separate characteristics, yet these are by no means obvious to the casual observer. Again, if we come to the matter of scenery, there is not much that can be advanced in favour of the land of the five rivers. From Delhi to Peshawur stretches a vast plain, fairly well covered with arable soil, thriving hamlets, and flourishing gardens; but there is little to relieve the sameness of the extensive table-land, which towards Mooltan, and indeed over a very considerable proportion of the country, fades away into a waterless and unprofitable desert.

The sub-division of Kooloo is made up, as I before remarked, of the sub-districts of Kooloo, Lahoul, and Spiti; all placed under the immediate charge of an Assistant-Commissioner, who has the administrative care and is also entrusted with certain judicial functions.

The three minor divisions of Seoraj, Wuzeere Rupi, and the Upper Beas Valley, form what we may term Kooloo; but I propose to confine my remarks for the most part to the latter, namely, the Upper Beas Valley. The Upper Beas Valley is hemmed in with mountains, which gradually attain a gentle elevation as they near the Rohtung Range that runs athwart it towards the north. The direct road from the plains of the Punjab, which is also the Central Asian route, winds from Kangra, at the foot of the Himalayas, through the Kangra district, across the state of Mundee, and descends by the Bubboo Pass (10,500 feet) into the town of Sooltanpore, from which point we ascend the Upper Beas Valley. The Bubboo is a wealth of richest forest to its summit; but in the other passes, which are more lofty, such as the Malanna (12,000), and the Humta (15,200), even the scrub-jungle that has fought for place as long as vegetation was a possibility, dies away altogether, and is succeeded by mighty crests of rock, battlemented with eternal snow

On the left or west side of the river-way there are also passes over the mountains, but these are seldom used even by the people of the district.

The River Beas, springing from a single rock of limestone on the summit of the Rohtung Pass, tears down the mountain-side with impetuous fury, and descending lower, plunges into a deep chasm, flanked by precipitous barriers of rock, not 20 feet apart, and often almost touching. Below, at a depth of over 100 feet, roar the wild waters, as they dash with impotent fury against the sides of the almost subterranean passage, that extends for some 300 yards. At the actual foot of the pass the Beas is joined by the Beash Khund, called the Serohi in the maps, and from this point to Sooltanpore, some 25 miles in all, its volume is added to by many feeders.

The river and the valley are in perfect harmony. Sweeping down in grand lines come the mountains, covered almost to their summits with dense pine-woods, while ever and anon are to be seen the hamlets of the peasantry, embowered in groves of mighty cedars, the Swiss-like architectural details of the houses bringing to one's mind scenes very far remote from the East. From the river's bank rise successive terraces of cultivated fields of rich green rice; but the sameness is relieved by the luxuriant growth of underwood that breaks the hard lines of uniformity, and thus the waving crops become but an additional feature in the landscape. On every side the giant mountains rear their snowy peaks. To the north, over the Rohtung Pass, can be seen the jagged twin crests of Gaphan, 19,000 feet above the sea; to the north-east are the Humta Spurs, lorded over by Deotiba, 20,417 feet in elevation; and to the west the Burra Bunghal heights, never entirely divested of snow throughout the year. Below, bisecting the valley sweeps the Beas, bounding over rock and boulder in noisy strength, its silvery tide frequently quite concealed by the umbrageous forest that adorns its banks—here pausing in peaceful quiet or gliding onwards with a murmuring ripple, and anon racing round some pretty sylvan island, joining its waters again on the further side; and rolling, tumbling, and frothing in many an eddy, whirlpool and rapid, it fights its way past Sooltanpore, where at last it moderates its impetuosity.

Let us leave the Upper Beas Valley, and, ascending the Rohtung Pass,—the first serious opposition that meets the traveller on his journey to Ladakh or Eastern Turkestan. The ascent from the Kooloo side is steep; but one can ride the whole way, the passage occupying about 4 or 5 hours. The summit of the pass is a flat level half a mile in breadth, and it is the march across this—over a mile in all—which at such an elevation (13,500 feet) becomes so very trying at certain seasons of the year.

We must now enter Lahoul, a very different tract of country to the one just quitted. Looking downwards from the top of the Rohtung we see a sterile land lying at our feet, through which courses the Chundra, or Chenab, that seems at this height, with its chalky tide, to be a mere wreath of snow in the vale below us. The forests, the hamlets, the terraced fields, have all disappeared, and in their places are precipitous hill-sides, for the most part even destitute of grass, and furrowed deep with the accumulations of ice which have lapped over from the tremendous glaciers. The mean elevation of Lahoul is about 11,000 feet above sea-level.

The Chenab and the Bagha, the latter joining the Chenab at Tandee after a course of 45 miles. The whole of the interior space between these streams may not inaptly be termed a vast ice-bed, broken here and there by lofty heights of impassable rock and snow—and here the mountains attain to a very considerable height; one of the peaks standing 21,415 feet above the sea-level, and below this towering pinnacle stretch out two glaciers, each over 12 miles in length.

But on both sides of the Bagha, as also of the Chenab, the mountains completely hem in the vales. The Chenab, or Chundra as it is called up there, rises in the Bara Lacha Pass, 16,500 feet above sea-level, and first takes a south-easterly course of over 30 miles, and then turns to the north-west to meet the Bagha at Tandee, 80 miles from its source. Leaping from a bed of snow on the south-eastern slopes of the Bara Lacha, the Chundra is, from its commencement, a stream of some size. It passes through a totally barren land, where there are no signs of life, the solemn mountains clad in eternal snow lying on its either flank; and, thus ushered into existence under such awe-inspiring auspices, it dashes its foaming waters by glacial banks of snow—vast reaches of gravel and decomposed rock, and here stretching into a mighty flood, again subsides to a more stealthy strength, as its icy tide flows onward through a country famed but for sterility, and that colossal grandeur that can only be imparted by vast mountains. Here no villages adorn its banks, no attempts at cultivation, no signs of human life are to be met with, and nothing greets the eye but the never-ending and monotonous cliffs, which are lapped by the fierce stream as it rushes in wild fury against its banks. Now widening out, the Chundra passes the remains of the Shigri glacier which some 80 years ago spread across the river and dammed it up, causing what is known as the cataclysm of the Chundra. Leaving the Rohtung peaks behind, some signs of man's habitation are at last to be seen; and, as we advance, villages squalid and forlorn

appear, which, on our nearing the junction with the Bagha, become more worthy of remark, surrounded as they are by scanty trees and a fair proportion of arable land.

We have now seen two of the valleys, and there remains but a third, which I will also briefly notice. Crossing the Humta Pass from Kooloo, we find ourselves in the Upper Chundra Valley; and, marching up this bleak country, taking with us all supplies of firewood and provisions to last for a week, we ascend the Koonzum Pass, 14,800 feet, and, emerging from that, enter Spiti, a valley, if anything, more hemmed in by mountains than even Lahoul, not one of the seven passes leading out of the country being under 14,000 feet. In Lahoul trees are to be met with, and, indeed, it can boast of two pine-forests, while the pencil-cedar and the willow are not uncommon; but in Spiti we must be prepared for an almost total absence of trees. The chief stream is the Spiti, which, with a very broad bed, and in many channels, flows far below the alluvial terraces, that can be fed alone by ducts brought from the beds of snow on the hill-sides. The main elevation of the Spiti valley is over 12,000 feet, and several of its villages stand 14,000 feet above sea-level. The landscape views are very grand and striking.

One of the most curious features of Spiti is its inaccessibility, for it can only be entered by passes; and one of these, the Parangla, is the loftiest, I believe, in British territory, standing, according to the measurement of Mr. Theobald, junior, who crossed it on 13th August, 1861, at 19,132 feet above the level of the sea. This pass is much used by traders between Ladakh and Spiti, and occasionally by tourists proceeding from Simla to the Pangong Lake. The crest of the Parangla is, says Mr. Theobald, a rocky ridge of vertical limestone strata forming a gap between high snowy peaks on either hand. Below stretches a fine glacier that fills up the valley beneath; but few crevasses exist in this glacier which can be crossed without difficulty—the track afterwards creeping along the chasm that yawns between the mountain side and the glacier. The Parangla is open from June till October, but is dangerous at all times, being very liable to sudden and severe snow-storms.

Climate.—The climates of the three valleys, as may be conceived, differ materially. In Kooloo the spring, summer, and autumn are remarkably genial and agreeable seasons; and although the winter snows fall heavily in the upper parts of the Beas river, in the lower portion of this district the inclemencies of winter are hardly known. The soil in Kooloo, except in the higher tracts, yields two crops annually. The main crops are opium, rice, tobacco, wheat, Indian corn, barley, and amaranth; but almost any description of grain or

vegetable grows to perfection. Fruits, such as the apricot, peach, quince, apple, walnut, and strawberry, are common, and are all good; and there are many others that grow wild and are held in favour by the people. Nor should I forget to mention the Kooloo tea-plantations, covering about 200 acres in all; the out-turn of these gardens being justly held in high repute in India, the leaf produced having a flavour quite equal to the best China samples.

In Lahoul spring commences in April, but the snow lies deep in the loftier valleys till near the close of that month. The summer is hot while it lasts, and the rainfall is always very trifling. In September the winter frosts set in, and from the end of December till April the entire country is covered with snow, and almost completely shut out from the rest of the world. The climate of Lahoul may be considered a very dry and bracing one, but towards the sources of the Bagha and Chundra the winds are bitterly cold, blowing like a hurricane all day, and subsiding altogether at night. There is only one annual crop in Lahoul. Wheat is but rarely reared, barley and buckwheat being the commonest cereals. The Moravian missionaries, whose mission-house is at Kielung, where they reside all the year round, and to whose kindly hospitality all travellers can bear the most willing record, have introduced nearly every kind of vegetable; but the people are too lazy to profit by this good example, and are content to put up with the tap-roots and such like esculents. Of fruits there are a few wild strawberries, cherries, and gooseberries; and apricots are sparsely grown, as are walnuts in the lower Chundra valley, below Tandee.

In Spiti the seasons are very similar to those in Lahoul, but here the winter is longer, and the cold more intense; and being out of the range of the regular monsoons, the rainfall is quite nominal. The climate is a singularly invigorating one, and at first somewhat trying to those unused to it; and the fierce icy winds make travelling anything but a pleasure in the more northerly portion of the district. The main crops in Spiti are a fine hexagonal wheat, peas, mustard, and two kinds of barley. Of fruits there are none.

Language.—In Kooloo the dialect in common use is formed out of Sanskrit, a hill patois, and Oordoo. In Lahoul there are four languages,—1st, the true Thibetan; 2nd, Boonung, half Thibetan, but having a grammar of its own; 3rd, Manchat, made up of Thibetan, Hindee, and a local patois; and 4thly, Teenum, in which are Thibetan, Manchat, Boonung, and a few Hindee and Persian words. All these languages have their separate locales. In Spiti the dialect is pure Thibetan, hardly ten men speaking or under-

standing Oordoo, the common language of the Punjab, and even the head-man, or Nono of Spiti, can only express himself in Thibetan.

Physiognomy.—The people of Kooloo partake largely of the distinguishing features of the Hindoos of the plains. The men are of a medium height, and are strongly built, with intelligent and rather pleasing faces, but in character they are for the most part crafty, dissolute, and lazy. The women are in many cases remarkably pretty, and their picturesque dress sets off their good looks to great advantage.

The Lahoulees are not a comely people; both sexes are short, and the females may be said to bear off the palm for ugliness,—the Mongolian origin of the race being evidenced in many cases by the oblique eyes, flat face, and large mouth. In Spiti the men are stout, well-built fellows, and the women are also strongly framed. The great majority of the Spiti folk resemble veritable Calmuks, and are, according to our view, hideously ugly.

Religion.—In Kooloo we find a debased Hindooism, built up on a superstructure of Buddhism, and snake and tree worship. The temples that for the most part have their regularly fee'd priests are of three different sorts, the cone shaped stone temple, the pagoda-roofed temple, and the pent-roofed temple. The former are very similar to what may be seen in the plains of India, and although of stone but few can claim an age of more than 250 years; the pagoda temples are, as are probably the pent-roofed ones, but relics of Buddhism, as is abundantly manifested by the lofty poles erected without their walls, that answer to the same Buddhist symbols in the Ceylon temples of the present day, and by the Buddhistical carvings of wheels, animals, and snakes, the worship of which it is known Buddhism incorporated with its own religious services. These two last descriptions of temples are of great age, and are not a little curious in an artistic and archæological point of view, being very massively put together, and run up with a skill which no longer can be said to exist in Kooloo, where, indeed, all handicrafts are in a very backward condition.

In Kooloo, Buddhism has quite died out, leaving behind it a substratum of tree and serpent worship engrafted on Hinduism. In Lahoul, however, there is Buddhism and Hinduism mixed, and with these two creeds is commingled a species of demon worship, termed Long Paechos, in the rites of which neither Brahmins nor Buddhist lamas will assist. But in Lahoul the Buddhist believes in Hinduism and the Hindoo in Buddhism; and in the event of any of the better class requiring the aid of the Supreme power, in the matter of

a good harvest or a fortunate speculation in trading, the ministers of both creeds are called upon to invoke the Deity. The priests in Buddhistical countries are, as I suppose most know, termed *lamas*, or more properly *lambas;* and while the eldest son succeeds to the estate, every other son becomes a *lamba*, so that the priestly class must always be in the majority. These lambas are supposed to be celibates; but in Lahoul Buddhism is not strictly acted up to, and many of the younger sons marry. In Spiti pure Buddhism reigns, and here every younger son is a lamba.

In Lahoul there are only seven real lambas, who devote themselves solely to religion; but there are 1100 lambas in all, who for the most part are married, and are "religious" only in name. In 1868 there were over seventy nuns in Lahoul; and one of these could actually calculate an eclipse! The parents decide when the girl is young if she is to be a nun; and if she enter a religious order, her hair is cut short and she wears a red cap, and resides during the winter in the monastery, generally ending by marrying one of the monks!

In Lahoul polyandry is a custom in full force, and three or four brothers, as a rule, have only one wife between them, as is the case in most Buddhist countries, though strangely enough not in Spiti, where the husband has only one wife, whom he marries by a regular religious ceremony: whereas in Lahoul there is no ceremony at all.

I have referred to the Kooloo temples, and I cannot altogether omit mention of the Buddhist monasteries in Lahoul and Spiti. In the former district these are few in number and small in size, but in Spiti there are five large *lamaserys*, besides numerous offshoots. The monastery of Kee, for instance, accommodates nearly 250 monks who reside in the sacred walls in winter, and stay during the summer with their parents or brothers and work in the fields, or are employed in carrying travellers' goods. These monasteries have their regular heads or abbots, and the higher ecclesiastical titles can only be obtained by the candidates proceeding in person to either Shangatzee or Lhassa. The symbols of this strange religion, which inculcates peace and good will to all men, and prohibits all destruction of life, are numerous and interesting.

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3. *Burma: Exploration viâ the Irrawaddy and Bhamo to South-Western China.* By Major E. B. SLADEN, H.M. Political Resident, Burma.

[EXTRACTS.]

THE Expedition which I had the honour to command left Mandalay by steamer on 13th January, 1868. One of our objects in pro-

ceeding by steamer was to test the navigability of the Irrawaddy for steam-traffic beyond or above the capital. Hitherto no steamer had ever ascended the river as far north as Bhamo, and the Burmese Government had publicly declared that no steamer could possibly do so at that time, or during certain seasons of the year, when the river was said to be at its lowest depth. Our steamer, however, the draught of which did not exceed 3 feet, reached Bhamo without difficulty of any kind in river navigation; and the result of our trip proves generally that the Irrawaddy is navigable for steamers of moderate draught at all seasons of the year, as far north as Bhamo, a distance of 900 miles from our starting-point at the Port of Rangoon, and 300 miles above the royal capital of Mandalay.

Throughout its whole course from Mandalay to Bhamo the river presents fresh scenes of ever-varying beauty; but the geographical interest of the journey culminates at the gorges or defiles which occur at two points in this portion of the Irrawaddy's mid-course through Upper Burma.

The following brief remarks on the third,* or most southern, of these defiles, about 60 miles above Mandalay, are extracted from my rough note-book, and were jotted down, I remember, on the spot, as my boat glided down the river on our return journey from Bhamo.

"*September 19th*, 1868.—Passed Sempanago at 11 A.M., and immediately afterwards entered the third defile. It seems endless, and, as far as appearances go, is so shut in at each bend in its course as to deny the possibility of exit altogether. Looking north and south from Thee-ha-dau,† the view is strikingly beautiful. The water is smooth, placid, and without a ripple. The scenery is no longer that of a river, but bears all the characteristic aspects of a mountain-girt lake. Does it bear any resemblance to the lake-scenery of Europe, or to some of the views presented on the Rhine in certain portions of its course? I think it does; but, if so, there are also many wide diversities. Here, at least, palm-trees of every variety rise above the banks. The forest-trees, on either side, are either hidden in orchids or their branches are borne down by a network of gigantic creepers. Graceful pagodas and Buddhistic remains seem full of an inspiration of their own, as they reveal themselves at each turn in prominent but yet modest profusion. Parrots flit across the scene with a screech, and monkeys form our

* The first occurs about 10 miles north of *Bhamo*.
† A village on the right bank, where coal is found.

escort on the banks. Dolphins occasionally pop up on the surface of the water, and turn themselves over with a lazy roll. Surely this is not Europe? We are in the tropics, with a vengeance, and the thermometer in my boat stands at 90°," &c.

The second defile, which occurs only a few miles below Bhamo, is so graphically described by a traveller who passed through it in November last* that I cannot help quoting a few extracts from his narrative. He says:—"About 11 o'clock we entered the second defile, which is about 15 miles in length. The scenery of this defile or gorge surpasses anything I have ever beheld. The river narrows in, whilst the banks on either side rise to a height of from 500 to 800 feet, and are covered with thick woods. The most striking part of the defile is a huge rock, which is called Monkey Castle, from the number of monkeys which hang about it. This is a vast perpendicular mass, rising, apparently, at least 800 feet above the glass-like river. It is impossible to describe our impressions of the grandeur of this wonderful defile. During the couple of hours we were passing through there was a continual change. Sometimes the stream took a winding course between the elevated and precipitous banks, with their towering forests; at other places we came upon a long vista of wood and stream. Here and there was a pagoda, or a village, or a few fishermen in a boat. On the whole, I do not remember any scene so calculated to please and astonish the eye—not by rude, wild precipices, but by glorious heights crowned with forests, and throwing their dark shade upon the smooth water."

The Expedition reached the Burmese frontier town of Bhamo, from which it commenced its land journey across the Kachyen Hills, in a north-easterly direction, towards the Chinese frontier province of Yunnan.

Bhamo itself (called and pronounced on the spot Bhamāw) was, only a few years ago, the emporium of a large trade between Burma and south-western China. The cessation of that trade, brought about by a Mahomedan rising in Yunnan on the one side, and the almost simultaneous occupation of Pegu by the British on the other, affected the progress and prosperity of Bhamo to such an extent that, from having been a place of comparative importance, it had dwindled down into insignificance, and at the time of our arrival contained only 500 houses, and a mixed population of Burmese, Chinese, and Shan Burmese, which did not exceed in all 5000 souls.

* Mr. Talboys Wheeler, Secretary to the Chief Company of British Burma.

For some reason or other, which I shall not at present try to account for, every attempt at exploration across the forbidden tract which lay between Burma and China had hitherto failed. This opposition appears to have been equally effective on both sides of the frontier, and as actively maintained by both the Burmese and Chinese Governments, for reasons for which they would doubtless find no difficulty in affording a satisfactory explanation.

I have it, on the authority of Don Abbona, a Catholic missionary priest, who was then in communication with his co-religionist associates in China, that Father Chauveau, now a bishop in Thibet, made three unsuccessful attempts to cross over from Yunnan to Momein. In these attempts he used considerable effort, and went so far as to avail himself of different disguises; but, baffled everywhere, he was compelled to desist, and relinquished all hope of reaching the Burmese frontier.

I have already said that our route, on commencing the land journey from Bhamo, took a north-easterly direction across the Kachyen Hills, an irregular transverse range of mountains, with an average breadth of 50 to 70 miles.

As seen from Bhamo, this great hill-range would appear to be a continuation only of the central Shan ranges which occur to the eastward of Mandalay. On examination, they turn out to be nothing more than secondary ranges, with an inclination E.N.E. and S.S.W., forming well-defined valleys, and determining the course of three of the principal affluents of the Irrawaddy in its mid-course through Burmese territory (the Moolay, Taping, and Shwélee).

These subsidiary ranges terminate abruptly, on their eastern and southern extremity, within a few miles of the east bank of the Irrawaddy; and the intervening space between their abrupt termination and the river is composed of low undulating ground, subject to occasional inundations, and alternately covered with high grass, low jungle, and occasional clearances with rice-cultivation.

But at their north-east extremity these same subsidiary ranges (confused and chaotic as they are as regards direction and configuration within the belt or zone known in Burma as the Kachyen Hills) open out into long, well-defined parallel ranges, with richly fertile and naturally exceptional and picturesque valleys, within which lies, and which in themselves comprise, the country hitherto only vaguely known to us by name as the Northern Shan States.

Pursuing these same ranges to their north-east extremity, we found them terminate or rather merge into the great central ranges of Yunnan, which, as seen from Momein, we estimate to attain to an altitude of 15,000 feet, with a general north and south inclina-

tion, and forming, no doubt, the principal watershed between the basins of the Irrawaddy and Great Cambodia (Mékon) rivers.

It is important to bear in mind this peculiar configuration of the country which intervenes at this point between Bhamo and the Chinese frontier, for it solves, in great measure, the very important problem of an overland trade-route which is to connect these two countries; and proves, moreover, I think, that the Burmese and Chinese populations and Governments, at a time when trade communication flourished in these parts, had both observed and availed themselves of the natural advantages of position and facilities for transit, which were presented to them by following either of these valleys,—which, by directness of course, general inclination and position, so invitingly held out the means of intercommunication and commercial intercourse between their respective countries.

It is further interesting, too, to note this configuration, because it discloses a geographical certainty, which nothing but exploration could possibly have solved.

I can well remember during several years' residence at Mandalay, and more especially during our six weeks' detention at Bhamo, trying in vain to imagine to myself, even with the aid of abundant enquiry—trying in vain, I may say, to form any definite idea in my own mind of the conflicting accounts given to us of the Kachyen Hills and the country which lay beyond them. Doubts are now solved, and we hold the proofs of personal observation.

I must again have recourse to extracts from my rough notes and official narrative of the expedition as the readiest and shortest means at my disposal in attempting a brief description of the country we passed through, its inhabitants, and some the incidents of our land journey as far as the Chinese walled city of Momein; but before I do so, let me say a word or two about the different races whose names repeatedly occur in my narrative, and of whom no succint details have hitherto been published. I shall refer—first, to the Kachyens; secondly, to the Shans (of the Northern Shan States); thirdly, to the Panthays, or Mahomedan Chinese of Yunnan.

The Kachyens of Burma are identical with the Singpos of India, or rather the Singphos of the hill-districts which intervene between Burma and Eastern Bengal on the north, including Assam. "Kachyen" is merely the Burmese name given to these hill-tribes; but wherever we came in contact with them, although broken up into a number of distinct tribal denominations, they always preserved the general term of Seng-Phaw, which they said applied to their race as a whole, and must be regarded by us as a clear indi-

cation of their identity with the Singphos, and probably also the Kakoo hill-tribes who range as far north as the borders of Assam.

Eastward, too, these Kachyens occupy most of the hill-tracts as far as Momein. In Burma they are spoken of as wild, ferocious, and intractable; but this arises out of ill treatment and the aggressive exactions of Burmese officials on the one hand, and retaliatory raids made by the hill-tribes on the other. In the Shan States, where the Kachyens are better understood, and live on terms of equality with their Shan neighbours, they are friendly and peaceably inclined, commit no excesses, and attend in numbers as sellers and buyers at markets, which are regularly held at several towns within the country known as the Northern Shan States.

Our own experience of these Kachyens is, that, under proper treatment, they proved themselves to be kind, tractable and intelligent, with a certain admixture of truth and treachery, which is inseparably connected with semi-barbarous nature all over the world. They are keen traders, work cheerfully for gain, and are hospitable to strangers. Their religion consists solely in the propitiation of good and evil spirits by sacrifices, and observances too numerous for mention. It may be stated, however, that mountains, valleys, trees, lakes, and even the sun and moon, are under the influence of presiding deities, or *nats*, all of which exercise power over the destinies of mankind, and demand propitiation. Ghosts are invariably believed in: they are said to be the spirits of those only who have died a violent death; they assume monstrous shapes, and are always dreaded as messengers of evil.

The Shans generally have been variously described by different writers who have visited the Southern Shan States subject to Burma, or the Siamese Shan States bordering on Siam; but no European traveller, previous to our expedition of 1868, seems ever to have come into contact, in their own country, with the Northern Shan States, which lie within the province of Yunnan.

Within these states we found Shans proper, who occupy the Sanda and Nantin valleys, and Mynetha Shans, who are confined principally to the Hotha and Latha valleys. The latter have a distinct language of their own, and their dress and other characteristics proclaim a Chinese admixture, in a similar degree to the Burmese admixture so traceable in the Shan races bordering on Burma. The wonder is, that, hemmed in as the Shans are by such distinctly pronounced nationalities as the Burmese, the Siamese, and the Chinese, they should have preserved so many distinctive characteristics of race, or that they should not have merged entirely

into one or other of the great nationalities by which they are everywhere surrounded.

The Panthays are Mahomedan Chinese, who being formerly subject to the Chinese Government, have within recent years risen in insurrection, and proclaimed their independence throughout the greater portion of Yunnan on the south, and the provinces of Shansi and Kansu on the north.

Their historical origin is somewhat indefinite; but most accounts of them, given by themselves, agree in the fact that originally they emigrated, or were sent over as a war contingent from Central Asia to assist some remote Chinese emperor in repelling a Chinese invasion. A return to their own country having been impracticable, the Central Asian contingent intermarried with Chinese, and for centuries past have been scattered abroad through different provinces of China, where they have managed to preserve a Mahomedan religion and nationality, and become powerful enough, as at the present time, to establish in different parts of the country a separate Mahomedan government.

It was by the friendly and active aid of these Mahomedan Chinese that our expedition was enabled to reach the city of Momein, then in their possession; but, having cleared the way thus far, I shall now return to that expedition, and commence with a short description of our start from Bhamo on the 26th February, 1868.

The 26th February is a day to be remembered in the history of our expedition. On the 25th our baggage had been despatched by boat up the Taping River to the village of See-kaw, where mules were engaged to be in readiness to transport us across the Kachyen Hills as far as the Shan town of Manwyne.

The officials failed in their promise to supply us with porters or guides, although they knew the latter to be indispensable, as the first portion of our march lay through dense jungle, which was intersected at short intervals by branch roads, which led no one knew where, and a broad unfordable river would be encountered, and could only be crossed by pre-arrangement entered into with Burmese officials. However we got off at 10 A.M., with incomplete attendants and no guides. A Burmese petty official was caught by accident as we rode through the town, and persuaded into accompanying the party, after carefully stipulating that I would use my influence at Burmese headquarters to screen him from after punishment for having given his aid to the British expedition.

It was owing to this aid that we were enabled to reach the village of Tahmeylon at 2 P.M., where we settled down at once into comfortable quarters in a deserted (Phoongyee house) monastery,

amongst model shrines carved in wood and inlaid with variegated looking-glass, a library of religious books, sacred alms-bowls, and complacent images of Gaudama in every variety of shape and profusion.

The baggage-boats, which left Bhamo the previous evening, passed up the river during the afternoon towards our proposed halting-place at See-kaw, which we reached ourselves on the following morning (27th February), and found there our mules and mule-men, with a few Kachyen chiefs and their Pawmynes, or deputies, who were afraid to trust themselves further in the vicinity of their Burmese oppressors at Bhamo.

Four days were passed in arranging with mule-men at See-kaw. The mules belong generally to petty proprietors, each of whom considers himself an irresponsible agent, with whom separate agreements have to be made in all that relates to the hire of his particular property. But as soon as the hire has been effected, new difficulties commence. The baggage was made over to the Kachyen chiefs, and these passed in review by the several mule proprietors, who had at once raised a clamour as to its apportionment into allotments. This clamour, in which we took no part, seemed likely to end in a breach of agreement, and repeated threats on the part of the mule proprietors to leave us without carriage altogether.

I was obliged to depend almost entirely at time on the Kachyen chief Ponlyne and a Chinese interpreter, Moung Shoay-yah, who had been specially made over to me by His Majesty the King of Burma. Both were occasionally drunk; but this was of no consequence, as drunkenness appeared to be the normal condition of all Kachyen chiefs when on duty, and was not regarded by them as in any way an interruption to ordinary business.

The expedition did not get away from See-kaw until 2 P.M. on 2nd March. Three Kachyen chiefs lead the way, the mules follow, and the police armed escort is told off to ammunition and cash-chest.

The route lay in a northerly direction, through paddy or grass fields, for a distance of three miles, as far as the small village of See-het; but here we turn abruptly to the right, and commence to ascend a steep spur of the Kachyen Hills, leading to Ponlyne. We had headed our baggage, and a temporary halt took place.

The three Kachyen chiefs, who had preceded us from See-kaw, were here seated, evidently in deep counsel, and much excited. As I came up, Ponlyne ran to meet me, and pointed out the road up the ascent, exclaiming at the same time "All right! go on; don't be afraid."

This was rather puzzling; for, hitherto, there had been no cause for apprehension of any sort.

But on we went. My pony was a good climber, and led the way. After ascending the hills some two miles, a shot was fired some distance in our front. I waited until Dr. Anderson had joined me. A second shot; then four shots all at once, but no sound of a bullet. The Kachyens of our party were most of them drunk. They shouted like fiends, and urged us to fire off our guns, which we refused to do, but went on as if nothing had occurred.

One of these Kachyens was mounted on a mule, and became more dangerous at close quarters, as a friend, than any numbers of our supposed enemies at a distance in the bush. In his excitement he flourished a long sharp sword, in reckless disregard of every one but himself. He became a still more formidable animal when the sword was sheathed, and his matchlock brought into active operation. Drunkenness seemed only to steady his movements, for, though riding over a road particularly rough, and in many places a steep incline, the matchlock was, nevertheless, loaded and fired with wonderful precision as regards time, but utter recklessness as regards direction. The man was both friendly and quarrelsome at the same time. A word out of place would have turned him at once into a foe, and the only way of keeping him in good humour with himself, and with us, was to praise his dexterity, and promise to renew his exhausted powder-flask as soon as we arrived at the village we were journeying to.

I shall now read from my Diary our first day's experiences on the far-famed Kachyen Hills at Ponlyne.

March 3rd, 1868.—Reached this place late last night. The Pawmyne conducted us to a native house, which had been specially set apart for our accommodation. None of our baggage had arrived; but there was a novelty about the scene and occasion which atoned in some measure for the absence, after a long march, of either bed or supper.

We stroll out and watch Kachyen women pounding paddy by moonlight. An old lady of the party beckoned to me to follow her, and I was conducted with a thrill of ambiguity as to results to a house at a little distance, where I found the Ponlyne chief himself surrounded by his family. It was a novel and interesting picture. The chief made me share his own carpet; the next seated themselves on blocks of wood or pieces of bamboo, and certain members of the family attended us with relays of Kachyen beer and Chinese shamshoo.

This morning we are informed that a portion of our baggage, including ammunition and cash-chest, has been looted by the Kachyen chief of Tahlon. As the day wears on matters improve. We find that mule-men, who were supposed to be missing, have merely herded together for the night at their own pet halting-places.

The Jemmadar, with the escort, arrived at 1 P.M. The Ponlyne chief has sent his own son to release our ammunition and cash-chest, which are being unaccountably detained by the chief of Tahlon. When they arrive, we shall have lost nothing of consequence, though things looked awkward at first, and the expedition was in danger of coming to an abrupt termination after its first march.

The chief's wife has paid us a visit in great state, attended by her family and a number of female companions. She brings presents of geese, boiled rice, eggs, and Kachyen beer (called Sheroo). She is a fine, intelligent, matronly-looking woman, and the "get-up," though a little *outré* at first sight, is by no means unbecoming. The head-dress consists of a black cotton scarf, with silk-embroidered ends, which is wound round the head as a turban and made to ascend a foot in height, in the shape of an inverted pyramid. The upper garment is a loose black velvet jacket, studded here and there with large silver embossments, which encircle the neck from behind and are continued in lines down the front and round the skirt. The lower garment is a single dark-blue cotton cloth, about a yard and a half in length, which passes once round the body from the waist to the knees, and is fastened in front with a simple tuck. It is edged at one end with a red woollen border, a foot in depth; and this decorative part of the garment is allowed by all Kachyen women to dangle on one side, with an effect which to Kachyen comprehensions is doubtless very captivating.

During the day we heard sounds of Kachyen music, and going in search arrive at a house on the outskirts of the village, in which men, women, and children are dancing vigorously to a rattling accompaniment of gongs and sticks, beaten by themselves. They do not object to our presence, and Anderson and I enter the house and join in the dance, which is a measured side-step with side-movement, crab-fashion. We go round in our proper places, and are enjoying a certain wild novelty in the arrangements, when suddenly the male dancers become wilder than ever, and rush madly out of the house, like demons; we remain inside with the women. The scene of excitement has given place to wailing and lamentation; two of the women retire, and we see them crying piteously over the corpse of a child, which has been carefully concealed in a side apart-

ment. The dance was a death-dance, and we, too, have joined in it, and thus helped, according to Kachyen belief, to drive from its late tenement the hovering spirit of the poor dead child. We sit down mournfully, and our female hosts hand round Kachyen beer in conical cups of plantain-leaf, which have been ingeniously improvised for our special benefit.

We did not leave Ponlyne village until the 5th of March. On the 4th the chief informed me that the nats, or spirits of good and evil, looked unfavourably on us, and required propitiation. This merely implied a demand for rupees. We accordingly accompanied the chief to his house, where we found all in readiness for a special ceremonial. The spirits of good and evil were about to be consulted through a Kachyen medium—a priest, who had separated himself for this purpose from his companions, and occupied a dark corner at the extreme end of the building. Here he crouched down and began to work himself into a fury of attitudinizing, stroked his head and face with both hands, tore his hair, sighed, moaned, groaned, and, finally, his legs, from the knee downward, were made to quiver, with a reverberation which repeated itself on the bamboo flooring with a sharp castanet-like sound, which is kept up incessantly during the remainder of the ceremony. We knew at once that the man was at last possessed, and beyond all self-control. His utterances, henceforth, were believed to be those of demons and nats, in a fury of anger, which promised even violence.

The chief whispered and asked for my propitiation. I put down 15 rupees, which were offered up on a platter made of plantain-leaves; but in a moment platter and rupees had been scornfully kicked to a distance. The chief approached with reverence and begged that the offering might not be rejected. No reply, but more groans and further evidences of dissatisfaction. I am appealed to and add five rupees, which was all that was wanted. The offering now finds favour and is accepted. Benedictions follow, and all that is good is prognosticated in our future travels.

We got off from Ponlyne on the 5th March. The route lay along the valley of the Taping. Every now and then the view was glorious. On either side hills towered up into mountains, and range after range succeed each other, apparently in endless continuity, till lost in the blue distance.

The village of Ponlyne is about 3000 feet above sea-level. The immediate descent from Ponlyne to the bed of the Nambouk River was steep and difficult for a distance of three miles; but the next four miles was occupied in crossing a succession of lofty spurs which abut into the valley from the main ranges. The Taping River is

constantly in sight; at times we descend almost to its bed, and anon it is roaring 2000 feet below us. It is, in this part of its course through the hills, a broad mountain-torrent, or rather a continuation of rapids, down which the water rushes with unceasing roar, and with a force which nothing could withstand, if we except prodigious boulders of granite, which lie occasionally across its bed or hang suspended on its immediate banks, with an inclination that suggests an inevitable downfall.

We encamped for the night in jungle, and started the next morning for Ponsee, which is ever memorable to us as the scene of our weary detention—I may almost say imprisonment—for a period of more than two months. I shall not attempt to describe the troubles, the discomforts, the vexatious annoyances to which we were subjected during the whole period of this detention. We were cut off from communication on all sides. Our means of advance or return were taken away, by the pre-concerted withdrawal of our mules. The enmity and resentment of the hill-tribes around us had been roused and encouraged by the most villanous reports of our objects and mission. Armed attacks were often threatened, but as often avoided. Time alone was our friend, by affording proof that in all our actions and intercourse with these new races they were gradually made to feel the genuine honesty of our intentions, and the friendly policy of the British Government.

I will here pass over ten days of inaction and quote from my diary of 17th March:—"Difficulties increase. The chiefs come early and pass several hours in small talk. The demand for old-mule hire has risen from 20 to 25 rupees per head. I offer 500, if carriage is procured as far as Manwyne. The chiefs reply—'You cannot go to Manwyne. The roads are held by armed men, who have been sent to oppose you. Leesheetahee (a well-known brigand chief) holds the pass at Mauphoo, and he has sent orders to all the Shan chiefs, and warned them not to allow you free transit,'" &c. &c.

Three weeks more must be allowed to pass without record. I shall now state what took place on 7th April, at a time when there seemed to be a chance of our release from Ponsee bondage:—"This has been an eventful day—in promise big—in effect, an abortion. Tents struck; and baggage arranged for an early start. The chief and his Pawmynes appear by turns; but the porters only begin to assemble at 8 A.M. The chiefs are divided amongst themselves; both parties are intent only on 'loot,' and vie with each other for the lion's share. Either party seizes at the most promising packages, regardless altogether of their size or weight. My small Japanned tin cases bring on a crisis. The chief's men have got

them, and the Pawmyne, who heads the opposite party, is savagely drunk. The small circumference of our encampment is filled with armed Kachyens. The Pawmyne makes a dash at my gold sword, which is carried by a Burmese. Williams is standing near, and recovers it with a wrench which was irresistible. Pawmyne is at bay for a moment, but rushes away excitedly, and suddenly reappears, with his slow-match in a blaze. He is within three paces of me; but before I could move he had primed and fired his piece into the air, with a loud report. There is consternation for a moment, but no immediate movement. All would have been quiet again had not one of our party unfortunately fired off his revolver, with unmeaning effort. There is now tumult and confusion. The Kachyens fly in all directions, as if panic-stricken. The chief is quiet, and justly appreciates what is going on. He excuses his Pawmyne, calls back his people, and after a time order is restored. But we did not get off, and although our departure was fixed for the next morning, it was not until late in the day that the Pawmyne appeared, and said, that owing to the chief having withdrawn his support, they could not assist us further, and that we might make up our minds to stay for ever, as far as they were concerned, at our present halting-place, in the vicinity of Ponsee."

Another month passed in inactivity; and it was now evident that our stay in Kachyenland had given rise to friendly attachments which the people clung to, as a means of continuing our detention rather than aiding our departure. Chiefs and people came in crowds from distant villages. Women and children were in the habit of daily visiting our camp with presents of rice, tobacco, vegetables, and beer, for which they obtained more than an equivalent in looking-glasses, beads, or other finery, which was immediately converted into a means of female decoration. The time spent in observing and conversing with these interesting groups was well repaid by the insight afforded into their domestic relations, and the opportunity it gave them of realising our friendly treatment, and the faithfulness of our intentions, as evinced by our close intercourse with them.

It was not until after the first week of May that the Panthay Governor of Momein had been able, as the result of our communications with him, to drive the brigand chief Leesheetahee from his stronghold at Mauphoo, and despatch certain of the Shan chiefs, or their deputies, to us at Ponsee, with the means of a further advance from that place, through the Shan States to Momein.

On leaving Ponsee, a gradual descent of 4 miles brought us to the foot of the large spurs, which slope down in irregular projections,

between the main ranges of the Taping Valley. We reach, in fact, the minor undulations which merge, so to speak, into the valley of Sanda, and the eye roams over a comparatively narrow expanse of plain, stretching away in a north-easterly straight line into space, but bounded laterally by two lofty parallel ranges of mountains from 3000 to 7000 feet in height, with an average intervening area of 4 miles. This, in short, is the Valley of Sanda, which, with its prolongation to Nantin, contains the three Northern Shan States of Manwyne, Sanda, and Mynetee (Muangtee). Throughout it is richly cultivated, and presents an endless succession of villages, which either skirt the bases of the high land on either side, or nestle within clustering bamboos on the margin of the Taping. The Taping itself—no longer a mountain torrent—has now become a broad placid stream, with occasionally well-defined banks, and anon shelving reaches of shingle or sandbank, as it winds its mid-valley course through the plain.

The 14th May was the day fixed for the march from Manwyne, and early on that day more than 3000 men, women, and children were present on the outskirts of the town to witness our departure. Our camp was crowded to excess with all the *élite* and fashion of a mixed Shan, Chinese, and Kachyen community. The population, generally, was well dressed, and the Shan women in particular were scrupulously neat and cleanly in their attire. Men wore loose jackets and trousers of dark-blue cloth; but the women indulged in a variety of gaudy dress colouring. Their jackets were either white or pale green, slashed with pink at the sleeves and collars. The skirt was dark blue, with a variegated silk embroidery a foot in depth and worn as a flounce. Fanciful leggings and pointed slippers, with an innumerable array of silver ornaments, necklets, earrings, bracelets, and chatelaines, of various kinds, completed a costume novel in its way, but, on the whole, rich and very singularly effective. We were escorted by several Shan officials, who led the way, mounted on ponies with huge red cloth saddles and padded coverlets, which raised them at least a foot above their animals' backs.

The whole day's march from Manwyne to Sanda disclosed fresh scenes of pleasurable interest. The monotonous grandeur of an apparently interminable valley, with its sublime ridges rising on either side of us 5000 feet, and running in straight parallels into space, was in itself a source of infinite admiration.

But to this estimate of its interest I must add that the whole valley area teemed with life, or with a population which had laid out every available acre into one vast garden of wealth and fertility.

Half-way between Manwyne and Sanda we passed through the Chinese town, or rather bazaar, of Karahokha, which consists merely of one broad street, flanked on either side by Chinese shops. On market days the whole intervening space is covered with a succession of bazaar stalls, in which butchers, bakers, druggists, and sundry Jacks-of-all-trades do a very thriving business. The gin shops or gin stalls probably do the largest trade of all. Five Chinese cash, or one-hundredth part of a rupee (about one-quarter of a farthing) is sufficient to purchase a small teacupful of a spirit which approaches in taste and potency to bad Scotch whisky. This is drunk freely, and probably, according to our ideas, to excess. But, somehow or other, no interruption is caused thereby to trade, and Shans and Kachyens thrive and are prosperous in spite of strong drinks and of unlicensed distilleries.

After leaving Karahokha the route lay northerly, and brought us to the foot of one of the many spurs which abut into the valley from the counterslope of the western range. The soil is red, and the prolongation and connection of these spurs with the eastern range is often traceable at certain corresponding points, where the red soil creeps up simultaneously on both sides in unmistakable relationship.

The town of Sanda lies at the foot of one of these red spur projections. It is the chief town of the Sanda Shan State, and contains, perhaps, 800 houses, with a population amounting to about 6000 souls. The houses at present represent ruins. The monasteries are mere bamboo erections, of temporary construction. There are neither temples, nor pagodas, nor minarets to proclaim the approach to a provincial capital. The remains of an old defensive loopholed brick wall may still be traced round a portion of the suburbs, but within its enclosure there is little save ruin and dilapidation. In 1863 Sanda was subjected to an irruption of Mahomedan Chinese. The town was first gutted by Panthay soldiery, and then handed over a prey to any number of Kachyen adherents, who professed at the time to favour the Panthay cause. Hence its present condition.

Leaving Sanda, the road led through paddy-fields for two miles athwart the valley, where it crossed a spur, and once more resumed a north-easterly mid-valley course in the direction of Mynela (Muangla).

The River Taping is crossed at the ford of Nammon, which represents at this season a vast expanse of shingly desert, and is in reality the dry bed of the Taping and Takaw rivers, at the point of their apparent confluence.

The town of Mynela (Muangla) lies on the left bank of the

Taping, at the base of a central spur, which seems to divide for a time the main valley longitudinally into two separate gorges, without causing any material deviation in the direction of the Sanda Valley itself, or the general parallelism of its high flanking ridges. As we approach Mynela (Muangla) from the west and south, the Taping is lost in an amphitheatre of hills which form a noble background to that ancient metropolis. It has entered the western of the two gorges into which the valley is here divided, and its source is traced to the village of Koo-yoon, 30 miles north, whilst the Takaw keeps to the eastern gorge and marks our route as far as Momein.

On entering the town of Mynela (Muangla), at 3 P.M. on 16th (May), we were conducted by the officials to a temple, which had been specially put into repair for our accommodation. It was a marvel as regards laborious structure and interior decoration, which seem to have been carried out with lavish expenditure, and represent brutes, heroes, and demigods, of extravagantly grotesque form and proportions.

Mynela (Muangla) is a larger, and, to all appearances, a more important town than Sanda. It contains 1200 houses, which, like those of Sanda, are built of sun-dried brick, with no upper story, with the exception of a Chinese bazaar held in the centre of the town. No attempt has been made to lay out the place into roads or streets. The various roadways leading through the town are mere connecting lanes, flanked alternately by the backs of houses on the one side, and by walled enclosures, with small covered gateways leading into petty courtyards, on the other. The general aspect of these Shan towns, as compared with the neat and cleanly appearance of the inhabitants, is disappointing, and is evidence of anything but thrift or wholesome domestic economy.

Each state is governed by an hereditary independent chief of its own, who is assisted by as many ministers as he may appoint, and by village *tamons*, or subordinate magistrates, selected by the several village communities.

A delay of a few days at Mynela became unavoidable, owing to the fact that the road in our advance was still reported to be infested with brigands, and the necessity therefore of our communicating with Momein before attempting the pass at Mauphoo. Our communications in this respect were successful, and we were joined on the 21st by three Panthay officers with a strong military escort, which was to conduct us onwards from Mynela through Nantin to Momein.

We set out, accordingly, on the morning of the 23rd, and a march of 2 miles brought us to the left bank of the Takaw. Here we

found our Panthay advance-guard halted. They said that a strong party of Dacoits were ahead, and intended to dispute the pass into the Mauphoo defile. The chief of Hotha joined us at this contingency, and his information coincided with that of the Panthay advance-guard as to the almost certainty ahead of armed opposition. The announcement at the time was thoroughly embarrassing. To have turned our backs on an uncertainty, without any positive assurances of real danger, would have ruined our *prestige* and destroyed all hope of further progress. To have remained where we were would have argued weakness, and invited the very attack which I was anxious to avoid.

An advance was, therefore, inevitable; but it was not until our police escort had been drawn up in a line and fired a very respectable volley (to try their muskets and reload) that the Panthay officers seemed disposed to move. They now exclaimed, "With fifty muskets like those, which all go off when required, we would march to Pekin even, in spite of all the opposition in the world." The march was resumed; but the Dacoits withdrew, alarmed, no doubt, at the sound of our volley. They left evidences, however, of their vicinity and of their cowardly revenge by cutting down and leaving in our pathway a poor traveller, who was gashed to death for the sake of a string of Chinese cash (value 2 rs.), of which he had life enough left to tell us he had just been dispossessed.

The valley had now narrowed very considerably, and as we approached its north-eastern extremity the only outlet consisted of a dark gorge or defile, through which the Takaw rushed with the roar and velocity of a mountain torrent. The sides of the gorge were precipitous rock, more or less scarped, which rose at intervals to a height of several hundred feet. No roadway was practicable through the gorge itself, and it, therefore, became necessary to ascend the western range parallel with the gorge, and proceed along it for 7 or 8 miles, until a descent could be made into the Nantin Valley, which is, in reality, a continuation only or prolongation of the Sanda Valley.

The far-famed stronghold of Mauphoo is situated on the high land above the gorge; and, as we approached, the picturesque appearance of its natural scenery was considerably enlivened by the addition of a numerous array of gay banners, with which a Panthay garrison had embellished its battlements.

The march from Mauphoo to Nantin will ever associate itself in our minds with the gratifying marks of hospitality with which the Mahomedan Chinese (Panthays) welcomed us within the limits of their own possessions.

Strong guards had been stationed at appointed intervals along the route, and the nature of the ground was such as to enable them to be seen in the distance in all the gaiety with which full sunshine, variegated costumes, long silver lances, painted matchlocks, and large flags, of multiform design and colouring, could possibly invest them. On our approach the guards severally beat gongs, fired muskets, waved flags, and otherwise, after their own fashion, evinced signs of greeting and salutation which would have done credit to the civilization and resources of any state in Asia.

The descent from Mauphoo brought us again to the bank of the Takaw River, at a point where it enters the gorge above mentioned, and through which it has eaten for itself a way from the Nantin into the Sanda Valley.

The average width of the Nantin Valley did not exceed 3 miles, and its well-defined terraces, or gradations of terraces, at corresponding heights on either side, were evidences of a lacustrine period, during which a gradual outlet was being worked through the Mauphoo gorge. Here, too, we found the Takaw spanned by one of those veritable Chinese iron suspension-bridges, the first of a series which assured us that we had passed within the confines of the Celestial empire.

We reached Nantin the same day as it was getting dark, and were conducted to the ruins of a Chinese temple, specially prepared for us. Shortly afterwards the Panthay Governor paid us a visit, accompanied by a nephew of the Governor of Momein and the Panthay "cazee," or magistrate.

On leaving Nantin the configuration of the valley had somewhat changed, and the eastern main range no longer continued to be a single continuous range, such as that which characterized its direction along the line of the Sanda Valley. There now appeared to be a ramification of irregular spurs, all tending in a northerly direction, and yet so closely allied to each other as to form a connected series of undulations; or, in other words, a broad expanse of uneven table-land, at some elevation above the circumjacent valleys.

The ascent to this table-land is commenced half-way between Nantin and Momein; and, as soon as the highland is reached, it slopes away again in a gradual series of descents as far as Momein, which is itself situated within the fork of two valleys: that on the west being a sinuous prolongation of the Nantin Valley on the one side; whilst on the east another small valley, between the Momein mid-valley ridges above-mentioned and the main eastern range (Deebay), which has again entered an appearance, and is here the

chief watershed between the Takaw and Shwélee affluents of the Irrawaddy.

The approach to Momein is very grand and very beautiful. We had been descending for some time the eastern side of the central ridges already described, and the road, after passing down a series of grassy undulations, led round the south of a tumulus-shaped hill, 1000 feet in height, crowned on its summit by a Chinese tower-pagoda. At this point Momein itself and its battlemented walls are suddenly brought into view, in a hollow basin, enclosed on all sides by hills, which slope down, apparently at different elevations, almost to its very walls.

But the most effective scene of the whole, as it then appeared to us (with senses by this time somewhat deadened to the attractions of mountain scenery), was that which presented itself in the foreground, half-way between our position at the foot of Pagoda Hill and the southern face of the city wall.

The Governor had thought fit to come out in full state to welcome us to his capital, and his guards and retinue formed a temporary encampment, which was intended to display at once the wealth and the resources of the Mahomedan Chinese Government. The encampment was marked out by a long line of flags of infinite variety, shape, and colouring. On coming near them, I halted to make preparations for meeting so formidable an array of our expectant friends. We were a very rough and dirty-looking group of foreign adventurers. A march of 23 miles over dusty hills and across muddy ravines had not added to personal appearances, or to that dignity of demeanour which would anxiously be looked for in the pioneers of trade and the representatives of western civilization. As all drew near, guns were fired, gongs beaten, and bands played. Standard bearers—some two hundred in number—lined both sides of the road through which we were to advance, and in front of them were ranged Panthay officers of all grades and in full uniform. Our appearance, as we filed through this martial gathering, must have been as novel to the Panthays, by reason of its unaffected simplicity, as their display seemed out of order to us, on account of its extent and comparative magnificence.

The reception was, undoubtedly flattering and courteous to excess, and as such produced feelings of gratification in those who had come almost as strangers to an unknown and unrecognized Government, and who, after several months of obstruction and annoyance, suddenly found themselves amongst powerful friends and raised to the position of well-favoured guests.

We reached Mandalay, on our return, on the 20th September

after an absence of more than nine months, during which, there and back, our journey had not extended over a distance of, perhaps, more than 1000 miles.

Sir ARTHUR PHAYRE said there could be no doubt that the governments of both China and Burma were opposed to the passage of Europeans from one country to the other, but the chief opposition came from the Chinese merchants settled in Burma and Yunnan, who were afraid of their commercial monopoly being destroyed. Major Sladen would shortly return to that country, and from the success which had hitherto attended his exertions, it might be confidently expected that he would overcome this opposition, as he had the other difficulties with which he had had to contend.

Sir JOHN BOWRING said it had been his duty, when he represented the commercial interests of England in the East, to endeavour to obtain such information as was accessible with reference to the communications between Burma and the Western Provinces of China. He experienced great difficulty in doing so, the existing monopolies being opposed to free inquiry and free trade. He therefore desired to know if Major Sladen had been able to obtain any reliable statistics with respect to the ancient, the present, and the prospective trade between the two adjacent regions. There could be no doubt that the capabilities of the districts were almost boundless. When he represented Her Majesty at the Court of Siam—thanks to the good sense of the king—the restrictions to trade were removed, and the consequence had been, that although when he first visited the country there were only two ships in the port engaged in foreign trade, at this moment there were upwards of two hundred. He did not notice in the paper any reference to the remarkable but little known tribes of China who represent the ancient civilization, and had never been subdued by the Tartars,—the Miaoutze. Once or twice he had had opportunities of talking with some of these people, and found them exceedingly original and rude, but still with that element which was the groundwork of civilization—the desire to get money. This was certainly a spirit among Oriental races which ought to be turned to good account.

General FYTCHE said good effects had already resulted from the expedition under Major Sladen. The Government had entered into a contract with an Irrawaddy company for steam communication weekly with Mandalay and once a month as far as Bhamo. It was stipulated that the steamers might bring down a certain number of immigrants every month. The great want of British Burma was population, and it was hoped that the Shans and even the Kachyens would be tempted to come down and settle in British territories, where there was a great deal of waste land.

Colonel H. YULE wished to know if Major Sladen had collected any information about the courses of the great rivers, such as the eastern branch of the Irrawaddy and the Shwélee, which the Roman Catholic Vicar-Apostolic of Eastern Thibet had stated to come down from Thibet. The Salween and the Cambodia were also rivers about which information was very much required.

Major SLADEN said he made inquiries in all directions, and Captain Williams, the surveying officer with the expedition, was particularly ordered to find out as much as possible regarding the sources of the rivers and their direction, but no information could be obtained. He did not believe it possible to discover anything about the rivers unless they were actually visited. The Shwélee is only an affluent of the Irrawaddy, and the inquiries he made led him to believe that its sources are not very far north of Momein. The Taping had its sources at a place called Koo-yoon, not 30 miles from where the expedition stopped. Colonel Yule, in the book which he published several years ago, estimated the trade from China at half a million; but as all the gold used in Burma, and all the silk—and the commonest people

there wear silk—came from China, he (Major Sladen) did not think half a million at all represented the value of the trade. He did not for one moment doubt that, if the route could be thrown open, the trade would amount to many millions in a very short time.

Colonel YULE: Were you able to ascertain from what part of China the silk came?

Major SLADEN said he had made special inquiries into this matter. No silk was grown in the vicinity of Momein, yet the people were able to supply the expedition with as much as ever they wished for. He could not, without reference to his notes, tell the names of the special silk-producing districts.

Colonel YULE said, if the silk which was imported into Mandalay did come, as he was rather inclined to think it did, from some remote part of the interior of China, that would add considerably to the importance of penetrating to Yunnan.

Major SLADEN said the great trade in silk along the route taken by the expedition did not now exist. All the silk at present used in Burma was brought by sea from Calcutta or elsewhere.

Mr. COOPER said, when in 1868 he was travelling westward from Bathang, he struck the banks of the Lan-tsang-Kiang (the head-waters of the Cambodia), and followed it down for 200 miles. From Bathang to Yunnan it was narrow and broken up by rapids, and altogether unnavigable. The silk formerly sent from Yunnan into Burma was the produce of the celebrated silk district of the province of Sze-chuen. The particular district was called Kiating-foo. Very little of this silk found its way to the eastern ports of China, as it was not so good as the silks of other parts of the country, nor so good as the Japanese silks. The trade between Yunnan and Burma had been undoubtedly very great, and was carried on as late as twenty years ago. The Mahommedan rebellion put a stop to it, for the Mahommedans carried fire and sword through the provinces, destroying a greater part of the population, and with the population of course the trade. When the country became more settled, no doubt a large trade would spring up; but he believed the bulk of that trade would be the importation of piece-goods from Rangoon, taken along the Irrawaddy to Bhamo, and thence overland into Yunnan. He met some Miaoutze in Sze-chuen, and they informed him that they were natives of the province of Quei-chow, one of the south-western provinces of China bordering on Yunnan. There might be independent clans inhabiting the fastnesses of the mountains, but as a rule they had been conquered. A proof of this might be found in the prophecy which existed in China with regard to the four wars—the Miaoutze war, the Mahommedan war, the Eastern Thibet war, and the European or "foreign-devil" war. The inhabitants of Eastern Thibet had been conquered, according to the prophecy; the Miaoutze had been conquered, and so had the Mahommedans; and the expulsion of the Europeans was still to come. This prophecy showed that the Chinese themselves regarded the Miaoutze as conquered people. In the north-east of Assam there is a tribe called Khamtis, which resemble the Shans; but the Singpos are totally distinct from the Shans and Khamtis, speaking a different language, and being more barbarous.

A MEMBER asked if the Miaoutze had any peculiar language.

Mr. COOPER said he only met them on the route from China to Eastern Thibet, and had not much opportunity of studying their language; but the language was distinct from the Chinese, and when conversing with them he had to employ interpreters.

Sir JOHN BOWRING said the Mandarins had informed him that they had been unable to subdue the Miaoutze.

Sir DONALD MCLEOD, with reference to Captain Harcourt's paper, said that

Kooloo, which possesses an almost European climate, produces the best opium that is grown in the Punjaub, and has also been found exceedingly well adapted to the growth of tea. The route through it, which Captain Harcourt had described, is the best route from Northern Hindostan into Thibet, and maintains its superiority, notwithstanding the efforts which have been made to establish a route through the valley of the Sutlej at a heavy cost. The Trans-Himalayan regions, which are at present so inaccessible to us, are pretty freely traversed by the people of Lâhoul and the Kângra Himalayas; and these think much less of a journey to the capital of Thibet, than of coming down to Lahore. The question of penetrating into the regions of Thibetan Tartary is one of growing interest; and he believed that any efforts which might be made to penetrate by one route will ultimately lead to the opening up of others.

The PRESIDENT, in returning the thanks of the Society to Major Sladen and Captain Harcourt for their respective papers, said they were of great interest, not only geographically but economically, for they both referred to trade-routes. Through the provinces to which Captain Harcourt had referred, most probably the future trade-route into Central Asia would run; while the route from Bhamo to Momein would afford a means of communication with China. The resuscitation of the trade along the latter route, however, would hardly be a proximate affair, for all the late official accounts from China represented the condition of Yunnan as becoming daily more and more disorganized. Villages were in arms against villages, and there was scarcely any possibility of passing from one town to another. The very last communications, indeed, sent from Talifoo took five months to reach Hankow, whilst under ordinary circumstances, a month would have sufficed. When the normal condition of society was resumed, however, no doubt trade would revive.

Extra-Sessional Meeting, Monday, July 10th, 1871.

MAJOR-GENERAL SIR HENRY C. RAWLINSON, K.C.B., PRESIDENT, in the Chair.

ELECTIONS.—*Sir William George Anderson*, K.C.B.; *George Tournay Biddulph, Esq.*; *J. H. L. Down, Esq.*, M.D.; *William Elliot, Esq.*, C.E.; *William Goodwin, Esq.*; *George Johnson, Esq.*, M.D.; *the Right Hon. the Earl of Pembroke and Montgomery*; *A. H. Reed, Esq.*; *William George Thorpe, Esq.*

ACCESSIONS TO THE LIBRARY FROM JUNE 26TH TO JULY 9TH.—'Reisen in Ost-Afrika.' By Baron C. C. von der Decken. Vol. II. Purchased. 'Geological Survey of Canada, from 1866 to 1869.' By A. R. C. Selwyn. Montreal, 1870. Presented. 'Wilhelm Haidinger.' By M. A. Becker. Wien, 1871. Presented. 'Voyages dans la Basse et la Haute Egypte.' 1809. By V. Denon. Donor Admiral Sir W. Hall. 'Florida; its Climate, &c.' New York, 1870. Donor S. M. Holmes, Esq. 'Astronomical and Meteorological Observations, U. S. Naval Observatory, in 1868.' Washington, 1871.

Donor Commodore B. F. Sands. 'The Industrial Progress of New South Wales.' Sydney, 1871. Donor Charles Cooper, Esq.

ACCESSIONS TO THE MAP-ROOM SINCE THE LAST MEETING OF JUNE 26TH.—'Atlas e Relatorio concernente a Exploração do Rio de S. Francisco, desde a cachoeira da Pirapóra até ao Oceano Atlantico, levantado por ordem do governo de S. M. I. Dom Pedro II. Pelo Engenheiro Civil, Henrique Guilherme Fernando Halfeld, em 1852, 1853, e 1854. Rio de Janeiro, 1860.'——'Atlas do Imperio do Brazil comprehendendo as respectivas divisiões, administrativas, ecclesiasticas, eleitoraes, e judiciaria dedicado a sua Magestade o Imperador o Senhor D. Pedro II., destinado á Instrucção Publica no Imperio com especialidade á dos Alumnos do Imperial Collegio de Pedro II., organisado por Candido Mendes de Almeida. Rio de Janeiro, 1868.'——'Trabalhos Hydrographicos ao Norte do Brazil dirigidos pelo Capitão de Fragata d' A. N. I. José da Costa Azevedo. Primeiros traços geraes da carta particular do Rio Amazonas no curso Brazileiro Levantada pelo Sr João Soares. Pinto Capitao-Tenente d' A. N. I. Coadjuvado de Belem a Teffe' pelo Sr Vincente Pereira Dias, Primeiro-Tenante do Corpo D'Engenheiros nos annos de 1862, a 1864.'

This extra-Sessional Meeting having been called together by the Council in order to give His Majesty the Emperor of Brazil, who is one of the Honorary Members, an opportunity of attending a Meeting of the Society, the PRESIDENT opened the business by saying, that the Fellows of the Society were always glad to welcome any of their Honorary Members who might attend their evening meetings; but they were especially proud of an occasion like the present, when they were honoured by the presence of one whose connexion with the Society was owing not so much to his distinguished position among the sovereigns of the world, as to the earnestness and success with which, from congeniality of tastes and appreciation of the value of geographical pursuits, he had availed himself of his exalted position to advance the true interests of this branch of science. To enumerate the various ways in which the Emperor of Brazil had shown himself a true friend of geography, as well by his personal encouragement and influence, as by the liberality of his government, would be, in fact, to give the history of his whole reign. There were lying on the table three splendid volumes: one containing in detailed sections a map of the River San Francisco, flowing to the Atlantic between the provinces of Pernambuco and Bahia; the second, a series of maps on a large scale of the great River Amazon, from the sea-coast to the Peruvian

frontier, a distance of 1900 miles; the third, an elaborate atlas of all the provinces of the Brazilian empire. All these works owed their origin to the liberal encouragement and support of the Brazilian Government, and unequalled as they were both in accuracy of detail and finish of execution, they furnished a noble monument of an enlightened rule. It was on the presentation of these volumes, in 1864, that the Emperor of Brazil was elected by acclamation an Honorary Member of this Society. Any one who wished to follow the progress of South American discovery, and to acquaint himself with the large share which the Brazilian Government has had in these discoveries, had only to consult the Anniversary Address delivered by Sir Roderick Murchison in the following year, 1865, in which our late President dealt with that subject with his usual lucidity and extensive information, bringing the subject down to the period at which he wrote. The measures which had since been introduced, with a view to promote intercourse between the sea-coast of Brazil and the Andean provinces in the interior, Bolivia, Peru, and Ecuador, would, he hoped, be dwelt upon by some of the gentlemen who might address the meeting that evening. Those measures bore witness, not only to a most enlightened policy, seeking to promote trade, and to bring neighbouring nations into amicable relations, but they also showed that the sovereign from whom they emanated was actuated by the same spirit of geographical enterprise, combined with sagacious foresight, which distinguished his great ancestor, Prince Henry the Navigator. His Majesty had founded in his own country a learned society similar to our own, called "The Geographical and Historical Institute of Rio de Janeiro." He attended the meetings of that Society, and, as he (the President) was informed, sometimes took part in the discussions, so that he would understand it was not becoming for him (the President) to do more on the present occasion than thus formally introduce His Majesty to the meeting. Before concluding, he believed it would be gratifying to the meeting if he read a letter which he had received from Sir Roderick Murchison, who was so deeply interested in the proceedings of the evening, having been President of the Society when His Majesty was elected an Honorary Member.

The following letter was then read:—

"MY DEAR SIR HENRY, 16, Belgrave Square, 10th July, 1871.

"I cannot allow this auspicious day to pass, on which so enlightened a Sovereign and so warm a patron of Geographical Science as the Emperor of Brazil, deigns to attend this special meeting which is held in his honour, without expressing to all our Fellows, through yourself, the sincere gratification

which I experience in seeing the commencement of your presidency thus signalized.

"It was my pleasing duty, whilst I presided over the Society, to dwell on the obligations we all felt when His Majesty cordially assented to our unanimous desire that he should become one of our Honorary Associates. His Majesty has, indeed, since afforded us the clearest proofs of the deep interest he takes in all our proceedings. For myself, personally, I have just reason to be proud that this illustrious Sovereign paid to your old President one of his earliest visits on his arrival in this country. Highly gratified as I was on that occasion, I felt intensely mortified that my state of health would prevent my being present when the Royal Geographical Society was specially called together to honour our Imperial Associate, and therefore I request you to read this brief note, expressive of my grateful feelings, to the meeting of this evening.

"Yours sincerely,

"RODERICK I. MURCHISON."

The EMPEROR OF BRAZIL, addressing the meeting in French, expressed the great interest he took in the objects cultivated by the Royal Geographical Society. He was an ardent admirer of English literature generally, and watched attentively the proceedings of that and other scientific bodies. He therefore valued the opportunity which had been afforded him of being present at one of the meetings of the learned societies of this great metropolis; and must tender his thanks to the learned President—Sir Henry Rawlinson—whose great attainments in Eastern subjects, and especially in the interpretation of Assyrian and other inscriptions had always been the object of his admiration. He sympathised deeply with the illness of their late President—Sir Roderick Murchison—whose career he had so long watched, and whose services to science he so much admired. He hoped Sir Roderick might soon recover his health, and come amongst them once more.

The PRESIDENT rose again, to ask the meeting to express their gratification at the kind words which had been addressed to them by his Majesty. They all fully appreciated the hope that he had expressed for the return to health of Sir Roderick Murchison. It was a great mortification to him, and a great pain to themselves, that he was not able to preside on that occasion.

The following Paper was then read:—

On the Races of the Peruvian Andes, and on the Communication between the Andes and the Atlantic. By C. R. MARKHAM, Esq., C.B., Secretary R.G.S.

THE study of the nature and degree of the civilization attained by the aboriginal Americans is especially interesting, because that civilization appears to have been self-developed. The three American empires of the Yncas, the Chibchas, and the Aztecs were based

upon the progress made in the arts of civilization by the tribes which composed them, and on the united efforts of those tribes after they had been welded into great nations. But the tendency of the united empire was to obliterate all the special characteristics of the component tribes, and to make it a task of extreme difficulty to classify or distinguish them. This difficulty is increased by the want of system in the early writings, from which alone we can now hope to derive our information. Yet it is only by resolving the American civilizations into their elements; by extracting from all reliable sources the names, localities, and characteristics of the component tribes; and by classifying them with as near an approach to accuracy as is now possible, that the enquirer can obtain any knowledge of the early history of the American races, or any idea of their origin. Without such classification, there is no sure foundation on which he can base any conclusion, and little to which he can apply his science for any useful purpose.

In a paper, which I have submitted to the Council, I have made an attempt at the geographical classification of the tribes which eventually combined to form the empire of the Yncas by sifting the authorities upon whom it is necessary to rely, by making a careful investigation touching the amount of credibility that should be allowed to each, and by attending closely to the conclusions derived from such considerations. I have discussed these points in considerable detail, and have given support to my views by references to authorities on each point as it arises; but I now only propose to submit, for the consideration of this meeting, the general conclusions at which I have arrived, referring the inquirer to the paper itself for the critical details.

The region inhabited by the nations which formed the empire of the Yncas is a long strip of mountain and coast line, bounded on the east by the forest-covered plains of the Amazonian basin, on the west by the Pacific Ocean, and extending north and south for 1500 miles, with an average width between the sea-shore and the Amazonian forests of 300 miles. This vast tract comprises every variety of climate, and contains within its limits the most prolific tropical forests, valleys with the climate of Italy, a coast region resembling Sind or Egypt, temperate hill-sides and plateaux, bleak and chilling pasture-lands, and lofty peaks and ridges within the limits of eternal snow. In such a country, with such a variety of climates and products, and where communication is so difficult, the various nations appear to have gradually developed their capabilities in almost complete isolation, and much influenced by the circumstances which surrounded them, during a course of ages. The tribal

divisions of the empire of the Yncas agree well with its leading physical aspects. They consist of six clearly-defined regions: four following the lines of the Cordilleras, one on the sea-coast, and the last in the eastern forests. The first is included in the old kingdom of Quito, having its southern termination at the knot of Loxa. The second reaches from the mountain mass of Loxa to the saddle which separates the drainage of the Huallaga and Ucayali basins, a distance of 450 miles, and comprises the Chincha-suyu division. The third, and most important region, is that which is drained by affluents of the Ucayali; it includes the home of the Imperial tribe, and I have, therefore, called it the Ynca division. The fourth comprises the basin of Lake Titicaca, and is known as the Collao. The fifth is the coast region, and extends along the shores of the Pacific from the bay of Guayaquil to the desert of Atacama,—a distance of 1200 miles. The sixth is that portion of the dense forest-covered region to the eastward of the Andes, which is peopled by emigrants from the mountains.

The Ynca region extends from the water-partings between the basins at the Huallaga and Ucayali at Cerro Pasco, to that between the basins of the Ucayali and Lake Titicaca, at the base of the famous Peak of Vilcañota,—a distance of 380 miles. It is enclosed between the maritime cordillera and the eastern Andes, and is entirely drained by the affluents of the Ucayali, except at one point, where it extends over the coast watershed. Every variety of climate is met with in this mountain region. Here Nature has worked on her grandest and most imposing scale. The scenery is glorious; the products of every zone are collected on one mountain-side; but the difficulties in the way of advancing civilization, caused by the mighty obstacles of Nature, are such as to tax man's ingenuity to the utmost. Humboldt has well observed, that "when enterprising races inhabit a land where the form of the ground presents to them difficulties on a grand scale, which they may conquer and overcome, the contest with Nature becomes a means of increasing their strength and power, as well as their courage." A country like this was well adapted for the cradle of an imperial race. It was inhabited by six aboriginal nations,—the Yncas, Canas, Quichuas, Chancas, Huancas, and Rucanas.

These nations were closely allied, and seem to have had a common origin. Inhabiting regions alike in all respects, their development depended on the same causes, and they had to encounter the same difficulties in their first advances towards civilization. In the prehistoric times there were, doubtless, many struggles for supremacy and leadership, until finally the Ynca nation achieved undisputed sway. The Ynca country, as defined by Garcilasso, was bounded on

the west by the precipitous gorge of the Apurimac, and on the east by the Paucartambo river. North and south it extended along the valley of the Vilcamayu, which passed through its centre. It thus consisted of a rich and fertile central valley, enjoying an Italian climate, and yielding corn and fruit in abundance, and a mountainous tract on either side, with pastures and rugged heights. Cuzco is on the western highland, between the central valley and the Apurimac. This district is about 70 miles by 60 in extent.

The proper name for the people of this tract is Ynca. All the heads of families were called Yncas, and it was not until later times that the name was assumed as the special title of the royal family. Even then the headmen of this original cradle of the imperial race retained the name of Yncas, but it was pretended that the title had been conferred upon them as a great favour. The universal tradition among the people was that the Yncas first appeared nearly in the centre of the home district. Thus, as far as tradition can pierce into the past, their civilization was altogether of indigenous origin and growth. The general belief, both of rulers and people, was that the first Ynca was of native and local origin, and they had no knowledge of the appearance of any strangers more civilized than themselves. A contrary belief, that the Yncas came from Lake Titicaca, rests upon a story alleged by Garcilasso to have been told him when he was a child, and on a similar version, received, possibly from the same source, by Zarate and Acosta. As against the united testimony of every other authority, this Titicaca story must be rejected as unworthy of credence.

We thus come to the consideration of a people which had been established from pre-historic times in the districts round Cuzco, and had gradually developed an indigenous power and civilization until it commenced a career of conquest, and its dominions assumed imperial proportions. It is not the object of my paper to discuss the various interesting points relating to Ynca civilization; excepting so far as some of them will assist us to eliminate Ynca elements in the history of other tribes, and so to attain correct notions of their original condition. With that end, however, I have considered the nature of the religious belief, of some of the customs, and of the language of the Yncas, as well as the character of their architecture, and the progressive stages of their advance in the art of building.

These points require more time for their discussion than it is possible to devote to them on the present occasion; and it would be useless to refer to such conclusions as are likely to be disputed, without quoting the authorities on which they are based. It will be sufficient here to say, that the six nations of this central Andean

region appear to have worked out their advances in civilization by separate roads, until increasing population brought them in contact with each other, when a struggle for supremacy ended in the mastery of the fittest—the Yncas. Being closely-allied branches of one family, speaking dialects of one language, they were soon welded together; and such people were sure, in the course of time, to overcome more distant tribes living in regions less favoured by Nature.

South of the Ynca region is that of the Collao, forming the basin of Lake Titicaca, which is about 300 miles long by about 150. It is bounded east and west by the mighty chains of the Andes and the coast cordillera, with the saddle of Vilcañota connecting the two ranges as its northern boundary, and with all the drainage from these surrounding mountains flowing into the great lake. The region thus enclosed averages 12,000 feet above the level of the sea, a hilly and broken plateau where no corn (save quinoa) will grow, and only yielding edible roots and coarse pasture for llamas and alpacas—a bleak and treeless series of unproductive plains and uplands. Such a country, differing so widely from the Ynca region, was not adapted for the development of indigenous civilization; and before the Ynca conquest it was inhabited by the rudest and most savage tribes in the Andes. Without timber, without corn, they dwelt in stone huts, tended their flocks, raised crops of *ocas* and *papas*, and engaged in incessant feuds. They were brave and warlike, but their only arms were slings and *bolas*, and they suffered much in encounters with the civilized soldiers of the Yncas. Their language was a rude dialect of the Ynca or Quichua, containing a most imperfect system of numeration, few words to express abstract ideas, and none for many things which are indispensable in the first beginnings of civilized life. The Collao must have been conquered by the Yncas in very remote times, and they conferred incalculable benefits on the inhabitants by teaching them a cultivated language and the arts of civilized life. The aboriginal tribes of the Collao were the Collas, Lupacas, Pacajes, Carangas, Quillacas, Urus, and Collahuayas. I have discussed at some length, in my paper, the evidences of Ynca influence on the language and habits of these tribes, and have thus endeavoured, by separating all Ynca elements, to obtain a correct notion of their aboriginal condition. My final conclusion is, that no grounds exist for believing that they were ever anything more than a race of barbarous uncultured shepherds before they came under the humanizing influence of their conquerors, and that there never existed any form of civilization in the basin of Lake Titicaca other than that introduced by the Yncas.

The tribes of the Chincha-suyu and Quito regions are also treated

of in my paper: all available information respecting their original condition has been collected together, and the elimination of Ynca elements has been attempted; but space will not admit of my dwelling on these points, and I pass on to the interesting tribes of the Peruvian coast.

The numerous valleys on the Peruvian coast, separated by sandy deserts of varying width, only required careful irrigation to render them capable of sustaining a large population. In these valleys we meet with a race of people who had made considerable advances in civilization, but who are quite distinct from the people of the Andes. They appear to have formed separate communities in the different valleys, each under a chief more or less independent. The most civilized and powerful was the Chimu, who ruled over the valley where the city of Truxillo now stands. The subjects of this prince were civilized, and his vast palaces, near the sea-shore, now form extensive ruins. The system of irrigation of the Chimu Indians was most efficient, and they had made considerable advances in the arts. But the Ynca conquest had almost obliterated the names and traditions of these coast tribes, even before the arrival of the Spaniards, and nearly all the names of places belong to the Quichua language. The fragments of the coast languages that have been preserved prove that the people were wholly unconnected with the Yncas and other mountaineers. Their languages are entirely distinct, both as regards vocabulary and grammatical construction.

This difference of language proves that the coast Indians did not, like their conquerors the Yncas, descend from the region of the Andes into the warm valleys. I have given detailed reasons, in my paper, for thinking that they were not the aboriginal inhabitants of the coast. Two alternatives remain. They either came from the north, and were offshoots from the gold workers and lapidaries of the Quito sea-board, or they arrived from beyond seas. We can form no opinion on the former possibility without a comparison with the languages of the northern tribes. There remains the other suggestion, that they arrived from across the Pacific Ocean; and the Indians of Lambayeque gave a full account to the Spanish conquerors of the arrival of their ancestors in a large fleet, with a green stone idol. The coast Indians have now almost entirely disappeared. Their languages are disappearing, the most important have ceased to be spoken; but their civilization is attested by several old writers, and is illustrated by ruins and by many works of art. They are the most mysterious as regards their origin, and in that respect the most interesting of all the tribes which formed the great empire of the Yncas.

It will be seen that these numerous tribes resolve themselves into two primary divisions, distinguished by a complete difference of language, sufficient to establish an entirely separate origin. These are the people of the four Andean regions, and the tribes of the coast. Their languages, when carefully studied, give us an insight into the original condition of the different tribes, and, with the aid of evidence collected from the earliest writers, we are thus enabled to resolve the great Ynca empire into its elements, and to classify its component parts.

It remains to notice the sixth division of the empire of the Yncas, which embraced a portion of the vast Amazonian basin. It was a part of the wise and enlightened policy of the Yncas to send colonies from the Andes into the great forests to the eastward, in order that there might be an interchange of products between the emigrants and their friends at home, and a consequent increase to their material comfort and well being. Great warlike expeditions were also despatched into those interminable forests. One of these, described by Garcilasso, is certainly historical. The Ynca Yupanqui, about a century and a half before the Spanish conquest, sent a large army in a flotilla down the rivers Amaru-mayu and Beni, and established an Ynca colony in the province of the Moxos or Musus. Some of the tribes conquered by the Yncas, also, unable to endure a life of subjection, fled from their mountain homes into the eastern forests; as in the case of the Chancas, who emigrated from the lofty plateaux near Guamanga into the valley of the Huallaga. These several causes led to the establishment of many colonies from the Andes in the basin of the Amazons; and Velasco enumerates a number of important tribes, especially on the Ucayali and upper Amazon, as having been of Ynca origin.

Thus the tribes of the Ynca empire moved down the slopes of the eastern Andes, and penetrated down some of the affluents of the Amazons. Here they encountered the tribes of the great Tupi family, and the limits where one race begins and the other ends cannot now be exactly traced. The subsequent disintegration of the nations in the Amazonian basin has obliterated old landmarks, and led to the disappearance and change of names and languages; so that it is no longer possible to identify the descendants of the Andean emigrants.

The Yncas understood the inexhaustible wealth of the eastern forests, and the value of the rivers as a means of communication; and the wise measures they adopted secured all the benefits that their resources rendered possible from those rich and prolific regions. The mighty Andes, with their snow-capped peaks, the thousand

rivers issuing from their sides, and the teeming forests remain the same for ever. But great changes have come over their inhabitants since those early efforts were made. The imperial Yncas have passed away; and, though strange vicissitudes and terrible calamities have pressed upon their descendants, there they still are, peopling the plateaux and slopes of the Andes, and, in these days, looking more than ever to the eastern forests and the mighty rivers for an interchange of products; and above all for the readiest means of communication with the outer world.

The Yncas did not dream that the rivers dashing down from their mountains into the dark forests of Anti-suyu, led to an ocean whence the arts and products of the whole world might be brought to their doors. Their descendants have dreamt this through many years, and now the dream is about to become a reality. The people of Peru, of Bolivia, and of Ecuador, see, in the mighty Amazon and her tributaries, a means of saving the ruinous land-carriage to the Pacific coast, and of turning Cape Horn by a flank march. The way is no longer through interminable forests, where no help can be found nor hoped for. Now a civilized empire extends over all the mouths and lower courses of the rivers flowing from the land of the Yncas; and the enlightened policy of Brazil now does more than help,—it takes the lead in opening the way from the Andes to the Atlantic, and from the Atlantic to the Andes, for the commerce of the world. The efforts of the last twenty years, and those now being made, while opening these great fluvial highways, and thus cementing the friendship and increasing the wealth of the riverine nations, will also have the effect of solving the most interesting questions in South American geography. They will have a momentous influence on the future of the races which formed the empire of the Yncas; and no time can be more auspicious than the present for a survey of the progress of the great work of exploration in the basin of the Amazons.

Few enterprises are more romantic than those of the first explorers of the mighty Amazons: the descent of the river by Orellana, the heart-stirring tale of the pirate Aguirre's cruise, the exploring voyage of Pedro de Texeira, the narrative of Acuña, the work of Condamine, and the labours of the missionaries. Yet thirty years ago less was known of the region through which the upper courses of the principal rivers flow, that rise in the Andes, than in the time of the Yncas. Since then the steady efforts of the Brazilian Government, with some assistance from Peru, and more recently from Bolivia, have done much to complete those explorations which are destined, in future years, to lead to such

momentous results. In October, 1851, as is well known, the Treaty was signed between Brazil and Peru to promote the navigation of the Amazons. Ireneo de Souza received his privileges in 1852, and by the year 1857 the Brazilian Company had eight steamers running from the mouth of the Amazon to Nauta in Peru, with periodical service up the principal affluents; while in 1867 a noble and generous Imperial Decree opened the rivers to the flags of all nations. The example of Brazil has led to attempts at emulation among the Spanish republics of the Andes, and, in Peru especially, several exploring expeditions in the valleys of the Huallaga, the Ucayali, and the Beni, have been undertaken with good results in recent years by Nyestrom, Maldonado, Raymondi, and more recently by a party led by Admiral Tucker of the Peruvian navy. Thus the whole course of the Ucayali, that great stream which drains the Ynca region, and its main feeders, has now been explored to within 360 miles of Lima. The Huallaga and Marañon are also well known. But the Beni, which drains the rich forest-covered hills and plains to the eastward of Cuzco, and those in part of Bolivia, is still little known; while its exploration will result in the opening up of one of the richest countries in the world—the *montañas* of Cuzco, of Caravaya, of Pelechuco, and of Apolobamba. For years the course of the Amaru-mayu, or "serpent river," flowing east from Cuzco and draining the slopes of the eastern Andes in that latitude, was the most interesting and the most eagerly discussed geographical problem connected with Peru. It is true that the old Ynca Garcilasso had told us, nearly 300 years ago, that it flowed into the country of the Moxos, and was, therefore, a tributary of the Beni. Yet modern geographers chose to assume that the Amaru-mayu, or Madre de Dios, was a main source of the River Purus, and, guided by these authorities, I was fully under the impression that I was exploring the sources of the Purus, when I penetrated to the Madre de Dios in 1853, and down the valley of Sandia in 1860. In 1865, however, Mr. Chandless made that thorough exploration of the Purus, by which he nobly earned the Gold Medal of this Society, and proved that the Purus did not reach to the Andes, and that, consequently, the Madre de Dios was not one of its tributaries. He then expressed an opinion that the Madre de Dios was one of the sources of the Beni, but we had all forgotten that Garcilasso de la Vega had stated this as a fact 260 years before. Afterwards, in 1867, we received intelligence that an enterprising Peruvian, named Faustino Maldonado, had actually solved the problem, and confirmed the accuracy of the old Ynca chronicler,

though at the cost of his life. He embarked in a canoe on the Madre de Dios, and was drowned in a rapid; but his surviving comrades continued the voyage and entered the great River Madeira, just as the Yncas had done four centuries earlier. If we had read our Garcilassos more carefully, and had relied upon the Ynca's accuracy, we should never have been led into these erroneous geographical guesses; and we must all now rejoice that it was reserved for one of the Ynca's countrymen to set us right, though at the cost of his life.

But these courageous attempts to explore the headwaters of the Madeira will not lead to practical results, unless the question of turning its rapids, and making the lower part of its course navigable, is grappled with and overcome. The Government of that great South American empire, which has now for many years made resolute and successful efforts to develop the resources and foster the trade of the Amazon valley, may well be trusted to continue this good work; and the Brazilians have already caused an elaborate survey, by M. Keller, to be made of the Madeira rapids.* Meanwhile the Bolivian Navigation Company has just sent out a small steamer, the *Explorador*, to act as a scout for an expedition about to sail from New York. She is to make the transit of the Madeira Rapids without being taken to pieces, by being rolled overland. She will then complete the exploration of all the chief affluents of the Madeira, including the Beni; will probably penetrate to within a hundred miles of Cuzco, the ancient capital of the Yncas; and will thus realize the dreams which have been indulged in, for many years, by some of the more enthusiastic inhabitants of that grand old city. Colonel Church, the Manager of the Bolivian Navigation Company, has been working indefatigably to complete the preparations for this important expedition, and for the construction of a railway round the Madeira Rapids; to which all true geographers must heartily wish success. While showing the way to the traders of Peru and Bolivia, the Company will be the means of promoting geographical exploration, and of completing our

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* *Madeira Rapids.* (18.)

Height of falls 26·4 to 0·98 feet.	Broken water 5000 to 328 feet.
Total height 272 feet.	Total broken water 64,505 feet.

Length of river in part containing rapid 229·38 miles
" " " 12·20 miles of broken water.
Difference between low water and floods, 10 to 23 feet.
Already there are 4 steamers below the rapids.
Railway round the rapids (projected) 168 miles.
Above the rapids, 2 steamers of 150 tons building (to come out in pieces).
3000 miles of navigable rivers above the rapids.

knowledge of a very important but hitherto little known part of South America.

Commerce is already treading close upon the heels of discovery; and Peruvian bark, hitherto shipped exclusively from ports of the Pacific, is now beginning to find its way to England, by the Amazon and Para. Señor Rada, and his young wife, were the first Bolivians to attempt this route, and their success, in 1868, has led others to follow in their wake. The brave enterprise of the Señora Rada reminds us that, if the mighty river is not entitled to the name of Amazons because the female warriors of Orellana are apocryphal, it yet may well have a name which will serve as a memorial of female heroism; for in no other region have the adventures of ladies been more wonderful, and in none has their endurance and courage been more signally displayed. There is nothing in romance to be compared with the tale of Inez de Atienza, and her voyage down the Marañon. Madame Godin, after all her companions had died of fatigue, pushed bravely on in her brother's boots, during nine days of wretchedness and nights of horror; until she reached a mission village of the Amazons, and effected her object—a junction with her husband. Finally, the young Señora Rada has been the pioneer of trade between Bolivia and England, by way of the great Brazilian river. If that river had a doubtful title to its name in the first instance, the heroic deeds of these brave ladies have assuredly made it most appropriate now, using the word in its best and most respectful sense.

Time will not permit that I should even touch upon other undertakings connected with the exploration of the Amazons and its tributaries, such as that of the Yavari, by the recent Boundary Commission, and others. In all these enterprises the Brazilian Government has taken the lead, and has shown an enlightened appreciation of the boundless capabilities of that great basin of the Amazons which Providence has blessed so wonderfully, and for which a bright future must surely be in store. The mind is almost bewildered in the endeavour to grasp within its compass a due conception of the stupendous proportions of that grand river, which flows so majestically through the most fertile of soils, and receives tributaries whose sources are thousands of miles distant from each other on either side. One naturally flies from the tension of intellect consequent on the study of its physical features, to dwell with pleasure on the picture of the great future which must be in store for the broad basin of the Amazons, when a constant flow of commerce will add fresh interest to its ceaseless tide. Nothing can be more likely to conduce to this consummation, than the

thorough examination of those splendid navigable rivers which form its chief affluents, and some of the more important of which are still so little known to geographers. In no other part of the world is there a grander field for geographical discovery and research. In no other part will the labours of the explorer be more richly repaid. I may venture to add, that in no other country has a more enlightened and liberal spirit been fostered and encouraged by a Government than in that great Brazilian empire, the ruler of which is himself a geographer. We all hope that His Majesty may long be spared, and that it will be his high destiny to enrich his own subjects by opening a way to the Atlantic for those Andean races, who are the descendants of the tribes which formed the empire of the Yncas.

The original and more detailed memoir of Mr. Markham will be published, entire, with Map, in the 'Journal,' Vol. xli.

Captain SHERARD OSBORN, after referring to a residence of some years on the eastern coast of South America, in what he called his "salad days," with Mr. Markham, bore testimony to that gentleman's zeal and enthusiasm in the cause of South American discovery, and said that the man who had carried the Cinchona plant from the western to the eastern hemisphere had done enough to make himself a name in the world. In looking at the map of South America he was struck by the sublime, yet simple, physical features which the continent of South America represented. To rightly appreciate this vast continent, a person must imagine himself in the home of the ancient Imperial race to whom Mr. Markham alluded, on the plateaux of that gigantic range whose culminating points rose twenty thousand feet above the sea, and which rose on both sides almost like a wall—that range running four thousand miles from north to south, from Tierra del Fuego to 10 degrees north of the equator. There, from the heights on which rested the great lake of Titicaca, was spread out beneath them, and looking eastward, a vast continent in the form of a triangle, comprising all the lands between the Andes and the Atlantic Ocean. Its area was twice the area of all Europe. In its centre, and facing you, rose a great irregular wedge-shaped block of land, the point towards you; that was the table-land of Brazil, estimated to be in itself of twice the extent of Russia in Europe. That wedge-shaped block separated tropical America from temperate and southern America. The northern plains were watered by the Amazon and the Orinoco, and those plains were calculated by Professor Mahlmann of Berlin, in Prince Adalbert's voyage, to be twelve times the area of Germany. The great plains to the south were watered by the La Plata, the Parana, and the Paraguay. Such were some of the grand physical features of South America. The magnificent plain to the north was described by a German philosopher as an "ocean of forest," extending from almost the top of the eastern crest of the Andes to the shores of the Atlantic. The rivers were manifestly intended by Providence, hereafter, as a means of intercommunication over the whole of that vast continent. Mr. Markham had pointed out what was being accomplished in this direction. Gradually and slowly communication was being opened up from the mouths of the Orinoco down to the mouths of the La Plata. The promotion of these objects offered an unlimited field for a future generation of geographers. He was sure the enlightened potentate who had honoured them with his presence would do all in his power to foster and to encourage a spirit of geographical discovery, not

only for the interests of his own vast empire, but for the benefit of the world at large. He had only to refer to the enlightened edict of the Emperor of Brazil, by which the navigation of the Amazon was thrown open to all nations, as a proof of his Majesty's disposition. It was a fortunate circumstance that this portion of the South American continent, which was the most progressive, was also the nearest to Europe. Already forty thousand Germans were settled in the high lands in the southern portion of Brazil. There was room there for the redundant populations of Europe, to be filled up, not perhaps in our own time, but in our children's time. He had recently turned his attention to the industrial and commercial prosperity of Brazil, and he was astonished, not having touched the subject for many years, to observe the marked progress that had been made. He might remark that a line drawn from Lisbon to Cape San Roque, in Brazil, was not greater than a line from Ushant to New York, passing by Halifax. We felt quite close, now-a-days, to New York; and he saw no reason why, in the course of a few years, our relations with Brazil should not be developed to a similar extent. Looking back to the past history of that country, Englishmen might recollect with pride that it was our Raleighs, our Ansons, and our Drakes who brought us into communication with South America; and, looking forward to the future, he could not help thinking there might be men, not so remarkable for their warlike temperament and their Conquistador spirit, who would help to promote the intercourse between Brazil and Europe, and also the development of the whole of the South American continent.

Mr. GERSTENBERG said, in connection with the introduction of the Chinchona plant into India by Mr. Markham, great credit was also due to Earl Derby, who, when at the head of the India Office as Lord Stanley, gave every facility to those who brought the subject under his notice. Also, in reference to the opening up of the Amazon, it was right to remember that Baron Mauá, who had had the exclusive privilege of navigating the Amazon for forty years with his own vessels, had voluntarily and gratuitously given up his privilege. He might also mention, in connection with the examination of the Purus by Mr. Chandless, that by the treaty of Ildafonso, in 1771 or 1776, the limits between Peru and Brazil were determined by the course of the Purus. Since then the course of the Purus had been pushed to the westward many degrees; consequently, Peru had lost and Brazil had gained a large quantity of land. We had never heard how that had been settled. Next, with reference to the communication betwen the Atlantic and the Andes, he was far more sanguine than Captain Sherard Osborn as to the period at which it would be realized. At the present moment nothing seemed to be impossible, with the mechanical skill, the power of steam, and the enormous public credit, which distinguished the present century. Nor was he satisfied with the prospect simply of a communication between the Atlantic and the slopes of the Andes. Any communication which stopped short at the Andes would not solve the requirements of the age. The task of the future would be to connect the Atlantic with the Pacific, as the United States had done without great difficulty; and he thought the task was feasible, because in the immense chain of the Andes there was a break in Ecuador which might be crossed. It would be a great joy when Brazil would be enabled not only to go up by the water to the foot of the Andes, but to connect the Atlantic coast with the Pacific coast.

Mr. HOWARD said he could bear his testimony to the skill, energy, and enterprise which conducted to a successful termination the journey of Señor Rada, resulting in the opening up of the river on the frontiers of Brazil to the traffic in Bolivian bark, specimens of which were on the table, and were worth from three to four shillings a pound. Señor Rada had to traverse some of the worst roads in the world to establish himself in the forests of Eastern Bolivia, where he had to provide for the felling of the trees, varying from 120 to 150

feet in height. In this he was assisted by his lady, and the task, though difficult, was accomplished. They had to build boats, in order to transport the bales of bark, which were tied up in the skins of animals, down the River Beni to Pueblos. Here they had to abandon the course of the river for fear of the savages, and to build carts, in which they conveyed the bark 60 miles across to another river to the east, called Mamoré. They then had to provide larger boats, and to navigate the Mamoré until it joined the Madeira. There they had the assistance of a steamboat down the Madeira, and so by the Amazons to Liverpool. The course of the Madeira was full of rapids, and the journey down was full of peril and adventure. A second expedition with bark had just arrived, but on this occasion Señor Rada had not accompanied it.

Mr. SEARLE wished to add his testimony to the services which had been rendered by the Emperor of Brazil. Previous to the opening of the river in 1867, he gave free passage to the Peruvian expedition, and he also granted the use of the arsenal at Para for the construction of two steamers. They must also recollect the services he had rendered to science by the assistance he gave to the expedition under Professor Agassiz, by placing a sloop of war at his disposal for the navigation of the Amazon. Mr. Markham had scarcely done justice to Peru. As long ago as 1865 the Peruvian Government had established a line of steamers, which had been regularly running from the Brazilian frontier to Yurimaguas, on the Huallaga.

Mr. BATES felt that anything he could say with regard to the River Amazon would be an old story. It was twelve years since he quitted South America, and eight years since the account of his adventures was published. He spent eleven years upon the river, wholly within the Brazilian territory. He was there long before steamers navigated those wonderful waters; therefore, he had to make his way by open boat, Indian-canoe, fishing-vessel, or the sailing schooners of the native traders. Afterwards, when steamers were established, he made many voyages by steamer. In that way he visited all the ins-and-outs, the nooks, creeks, and lakes of that magnificent labyrinth of waters. He ascended the river for a distance of 1800 miles from the sea. Nothing gave him a more exalted idea of the navigability of the Amazon than a voyage he once made by steamer, for a distance of 400 miles on the Upper Amazon. The voyage was made in the height of the dry season, when the waters were at their lowest, and yet, in the darkness of an equatorial night, the steamer sped along at the rate of ten or twelve knots an hour. So broad and so deep was the channel, that there was no fear of running aground on either side, and that at a distance of from 1400 to 1800 miles from the sea. On each side of the main channel there was a system of side channels, both to the north and to the south of the stream, sometimes connected with great lakes, 20, 30, and 50 miles in circumference, all deep enough for the navigation of large vessels, and having a habitable and fertile territory all round. The Brazilians called the Amazons the "Mediterranean of South America," and that was an apt and true expression; it was a Mediterranean of fresh water, with tracts of country on its banks capable of supporting a populous and wealthy nation. His investigations had little to do with the political and social questions which the paper had suggested; but it was impossible to avoid putting to oneself the question what was to become of that great country, and that great system of inland navigation. For a distance of 1900 miles, with an average breadth of 400 or 500 miles of river valley, the whole population did not exceed that of an ordinary agricultural county in England. Where was the population to come from to occupy this vast domain? That was one of the great questions of the future. He had faith in the future, and he believed this country would become the abode at some future day of a happy, civilized race of men.

The EARL OF DERBY said it was true he had been in South America; but it had never been his good fortune to set foot within the empire of Brazil.

This he would say, that those who had not witnessed the scenery of the South American continent, did not know what the splendour, glory, and beauty of Nature could be. With the single exception of the United States, there was no territory comprised within a single geographical area and under one government which could compete in point of natural capability with the Brazilian empire. Although it was our interest and our duty to be upon good terms with all the nations of the world, if they would let us, yet there were peculiar reasons why a cordial understanding should exist between England and Brazil. The reason was this,—that each country possessed what the other wanted, and each wanted what the other possessed. We, with our limited area, had an enormous command of capital, and a supply of skilled labour which was practically without limit. On the other hand, Brazil had an enormous geographical area with vast undeveloped resources, and a scanty population with small capital. Therefore, on one side there was a State, whose natural function was to supply capital, and, on the other side, a State whose function it was to utilize the capital so supplied. On the one hand, a State whose economical destiny it was to produce raw material in continually increasing quantities; and, on the other hand, a state whose natural destiny it was to work up that raw material so supplied. More than that, it seemed to be our function to send out continually to one country or another, able, hardy, and energetic emigrants, whose destiny it was to mix with other nations, and to influence the future of the world. Brazil had an unlimited area to receive emigrants, and although, undoubtedly, tropical countries, as a rule, did not suit European constitutions, still that was a rule to which there were many exceptions, and in Brazil was to be found almost every variety of climate. In past times there had been some diplomatic differences between the two States, connected with questions which were now for ever set at rest. These being disposed of, he knew no reason, political, social or economical, why the relations between the empire of Brazil and the British empire should not be of the most friendly and most cordial character. He heartily hoped and firmly believed that it would be so.

The PRESIDENT, in closing the proceedings, said the discussion furnished an instructive commentary on a doctrine he had frequently propounded: that geography, after all, was a thoroughly practical and utilitarian science. He had frequently remarked that the explorer of unknown regions must not be viewed in the light of a mere *dilettante* traveller, but as the pioneer of commerce and the herald of civilization. Such had been the case with regard to Brazil. He would not attempt to follow in detail the information which they had been receiving from so many sources with regard to the geography and economical wants of Brazil; he would merely draw attention to the vast area which they had been considering. The entire length of the Amazon from the coast to its source was 3500 miles, of which 3000 miles were navigable. Such a navigation truly deserved to be called the Mediterranean of South America. In conclusion, he begged to assure the Emperor of Brazil, in the name of the Meeting, that the Royal Geographical Society thoroughly sympathised in all his Majesty's efforts to promote geographical discovery; and that they heartily desired to co-operate with him in any measures which he might introduce for that purpose; sincerely hoping that what already had been so auspiciously commenced, might in the future be carried to its full development.

ADDITIONAL NOTICES.

(Printed by order of Council.)

1. *Captain Hall's Arctic Expedition of* 1871.

1. *Letter from* Captain the Hon. W. J. WARD, R.N., *on the Expedition.*

(Communicated by the LORDS COMMISSIONERS OF THE ADMIRALTY.)

"Washington, May 26th, 1871.

"IT has already been reported that Congress has made an appropriation for the fitting out and support of an Arctic expedition to be conducted by Captain C. F. Hall, the well-known Arctic explorer.

"The Navy Department has given the wooden gunboat *Periwinkle*, 387 tons (now called *Polaris*), to be equipped for this service. This vessel, during the past three months, has been double timbered and double planked, and otherwise strengthened for the intended voyage; her forepart as far aft as her foremast has been plated with iron. She is not coppered. Her engines are nominally of 80 horse-power. An arrangement for utilizing blubber as fuel is now under experiment in the vessel. The *Polaris* is to be ready for sea on June 1st.

"The expedition consists of Captain C. F. Hall; Dr. Bessells, a young German naturalist and Doctor of Medicine; Mr. Greene, an astronomer from the Michigan State University; Captain Beddington, a New London whaling captain, goes as ice master. The Army Signal Corps is to supply a meteorologist. The crew proper is to consist of 23 picked men. The Esquimaux Joe and Hannah accompany the expedition as interpreters; making a total of 30 individuals, including the Esquimaux.

"Captain Hall's object is to reach the North Pole, and collaterally to satisfy the question as to the existence of a Polar basin. He takes with him the man Morden, of Dr. Kane's late expedition, who was one of the two people who viewed open water northward from Cape Constitution in Kennedy's Channel. I have seen Morden; he believes firmly in the existence of a Polar sea. He speaks of having seen immense flocks of wild-fowl flying northward, and other indications of a less rigorous climate further north. Captain Hall hopes to get away in the *Polaris* from Washington on 1st June, en route for St. John's, Newfoundland, as his first calling point; from thence he will make into Davis Strait, keeping the Greenland shore inboard for Disco, touching, perhaps, on his way, at Holsteinborg. Captain Hall hopes that this Government will send a transport with him as far as Disco, and complete him with provisions and fuel before he finally embarks on his perilous undertaking.

"From Disco Captain Hall will endeavour to make Cape York. On the Greenland shore he hopes to enlist Esquimaux; and he will endeavour to procure as many as a hundred dogs for sledging purposes.

"To people who have read Captain McClintock's interesting history of his voyage in the *Fox* it may seem difficult to suppose that headway may be made as far as Cape York in a single summer. Captain Hall expects to reach a point much further before he finds his winter quarters. He anticipates this year an unusually open season, for the reason that an immense

accumulation of packed ice, the collection of several years, had last year broken up and found its way into open water through Davis Strait; thus enabling him to open a way through Jones Sound, by which entrance he hopes to reach the North Pole.

"From Disco and Cape York the *Polaris* will cross the entrance to Smith Sound, enter Jones Sound, and follow the western shore of Ellesmere Land, until a position in about lat. 80° and long. 85° is reached. Captain Hall confidently hopes to reach this position, and this year, before the daylight leaves him. He will here winter and organize his sledging parties for the coming spring. In the early part of April, 1872, he hopes to start his parties tracking on ice along the coast of Ellesmere Land north to the Pole.

"Captain Hall believes that Grinnell Land, a continuation of Ellesmere Land, reaches, if not actually across the Pole, very near to that point; thus, as he has told me, he will track on ice, which is fixed, or, so to speak, anchored by a coast-line, and thereby avoid travelling on a constantly southward moving floe, as was experienced by Parry in 1827 north of Spitzbergen. This is Captain Hall's reason for attempting Jones Sound instead of taking a course by Smith Sound and Kennedy Channel, from which the open sea was viewed.

"If the sea is hopelessly packed off Coburg Island the *Polaris* will try Smith Sound. The object is to reach the Pole; if it costs five years in the attempt, it will be prosecuted.

"Captain Hall expects to be absent three years. He has already spent seven years of his life with the Esquimaux, and can live and feed as one of themselves. He is an enthusiast, and prefers this life to one of a more ripe civilization. This expedition can hardly be called a Government enterprise, though it is formed and sustained by public money. Captain Hall, since his last return homeward, has enlisted the sympathy of many people to back his desire for furthering Arctic exploration. Last year Congress was prevailed upon to grant 50,000 dollars in aid of the enterprise. In March of this year a similar sum was added. To start the expedition the Navy Department have equipped the *Polaris*. The President has given Captain Hall a commission. Outside of this, as I understand, the Government is to assume no control, and Captain Hall is free to find his own way to the North Pole.

"I have, &c.,

"(Signed) W. J. WARD,

"Captain R.N., and Naval Attaché.

"*Sir Edward Thornton, K.C.B.*"

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2. *Letter from* H. P. TUTTLE, Esq., *on the same subject.*

"Naval Observatory, Washington, United States of America,

"DEAR SIR, "August 5th, 1871.

"I suppose you may have seen in the papers some account of an expedition which recently sailed from New York for Arctic seas. The expedition is fitted out entirely at the Government expense, and is under the command of Captain C. F. Hall, who has spent some years in the Arctic regions in search of the remains of Sir John Franklin's expedition. The *Polaris* is a fine vessel of 387 tons burthen, and has been thoroughly refitted for this special service. Dr. Bessells, who was the scientific director of the German Arctic expedition of 1869, is in charge of the scientific department.

"It is Captain Hall's intention to proceed up Jones Sound, and if the ice will not admit of further progress towards the North, to leave his vessel

in some secure place, and make the passage overland, or over the ice, as circumstances will permit. Captain Hall is a man of determined energy, and if he does not reach a higher latitude than has yet been reached it will be owing to bad management, as no vessel has ever gone so well provided as the *Polaris*. Everything asked for by Captain Hall and Dr. Bessells has been freely given, and the Government has dispatched the frigate *Congress* to the island of Disco with additional supplies of coals and provisions.

"I enclose a copy of the Act of Congress, making the appropriation of the vessel, supplies, and money. No naval officers go with the expedition. The *Polaris* sailed from New York about the last of June, and from St. John's, Newfoundland, about July 20th.

"Very truly yours,

"*H. W. Bates, Esq.*" "HORACE P. TUTTLE.

Act of Congress relating to Expeditions toward the North Pole.

Approved July 12, 1870.

"Sec. 9. And be it further enacted, that the President of the United States be authorized to organize and send out one or more expeditions towards the North Pole, and to appoint such person or persons as he may deem most fitted to the command thereof: to detail any officer of the public service to take part in the same, and to use any public vessel that may be suitable for the service; the scientific operations of the expeditions to be prescribed in accordance with the advice of the National Academy of Sciences; and that the sum of 50,000 dollars, or such part thereof as may be necessary, be hereby appropriated out of any moneys in the Treasury, not otherwise appropriated, to be expended under the direction of the President."

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2. *Account of Cagayan Sulu, near Borneo.* By Capt. W. CHIMMO, R.N.

Cagayan Sulu is situated on the north coast of Borneo, about 60 miles, being in lat. 7° N., and long. 118° 27′ E., and conveniently situated for a port on entering the Sulu Sea from China, India, or Australia through the Balabac Strait.

It is about 25 miles in circumference, nearly on every point surrounded by a fringe reef of coral, in a very active and progressive state, and which affords protection to canoes, and rafts made of bamboo, to travel from one point to another in smooth lanes of water, enabling the natives to pursue their fishing, on which they chiefly exist, without being subject to heavy seas.

The general elevations of the hills are from 300 feet to 1000 feet above the sea, some covered with long grass, others with trees and coco palms; the undulating park-like grounds with groups of trees—lime, areca palms, and plantains in the midst of long grass; the margin of the island on the low ground terminating generally in mangroves, except where it is elevated, and then there are coco-nut palms, and the tall and graceful casuarina trees.

The natives are mostly Malays from Borneo, and are independent; they live in thatched huts, elevated on poles at some distance from each other, having small gardens of bananas, sweet potatoes, yams, coco-nut trees, and long grass around each, and their graves among them; but many families live in one hut; and around the chiefs' houses are level and well-kept playgrounds, railed in with bamboo, for football and shuttlecock.

The whole island, as well as the group of small islets off it, is evidently

volcanic. On the two grassy-green hills which face the south-west anchorage are the sites of two extinct volcanoes, the craters of each being about 600 feet in diameter, and about 80 feet deep, the circular lips inclining to the south-east, as indeed they all do.

There are also several other craters, one on the north-east side, one on the east extreme; but the most remarkable and interesting one is on the south face of the island, which is entered over a coral reef, through which a passage is formed in the narrow neck of cliff, consisting of thin layers of trap, sand, gravel, and stones, and communicates with the sea.

I visited this crater in the midst of a torrent of rain, thunder, and lightning, which seemed as if the heavens had opened to swamp us while sounding its depths. This remarkable crater lake, which is nearly circular, having a basin of deep, dark-blue water of 320 feet in depth, the cliffs around clothed with trees reflecting their dark shadows on its surface, with 90 feet depth at the distance of a boat's oar (17 feet) from the rocky margin. The temperature of the bottom of the lake at that depth (53 fathoms) was 83°, its specific gravity 1·0220, while the surface water was 83°, and the air 78° only, after a heavy rain; while at the ship's anchorage the sea was 81°, and the density 1·0222.

The bottom in the centre consisted of soft yellow adhesive mud, with a strong sulphuric smell perceptible the moment the cup-lead, which brought up several pounds of it, came to the surface. This mud, when thoroughly washed and placed under the microscope, although impalpable and free from all grit to the touch, revealed the most marvellous field of minute and microscopic beauty, including many *Foraminifera* and *Diatomaceæ*.

Climbing a rugged and slippery network of roots, ferns, and stones to a height of about 100 feet through a solid and perpendicular stone gap, we saw to the eastward another lake of fresh water as large as this one, and into which a stone was let fall. The same perpendicular cliff was a wall for both lakes. It was impossible without great delay to get a boat on this lake to ascertain its depth.* It was nearly circular, and its waters gushed through fissures in the rock, near some caves or grots, at an elevation of 40 feet above the salt lake, the temperature of which was 84°, quite warm to the feeling, and disagreeably warm to drink. In the sediment of this water were some minute *Algæ*, a snake-like form jointed and spined (microscopic), and a few small globular bodies darting about among the *Algæ*. The natives say that there are alligators in this lake, and of course there must be fish.

The gap of perpendicular massive walls formed between the cliffs, dividing the salt-water crater from the fresh, was very grand, and upwards of 200 feet high, the top bare, but the base clothed with creepers, ferns, areca palms, and other trees, the ledges of some forming the resting-places for sea-fowl, and especially for the white and grey heron, and had a very curious effect from the sea, appearing at the distance of five or six miles like a huge building, with numerous people looking out from the tiers of balconies.

This gap could not have been formed, as Mr. St. John supposes, by the inner, or "fresh-water lake, bursting its boundary," as the south-eastern lip of the crater is of less altitude, nor were any *débris* found at its base; but it was formed evidently at the period of the great volcanic disturbance of the whole island.

The salt crater-lake is fed from the ocean, and at every tide replenished, but the fresh-water one is fed by rains, or springs, or both, as the temperature 84° indicates; and this coincides with the temperature of some of the springs found along the shore, although some were cold springs 83°, while others were hot 87°. Some of these issued from masses of conglomerate sand,

* Another opportunity will be taken to visit, sound, and examine this lake.

stones, gravel, &c., in a fused state; others from a split rock of lava (honeycombed), while others came up between rock and conglomerate.

* * * * * *

The salt lake abounds with fish, some of which occasionally skipped over its surface, and, as the rain fell, sipped its globules. This lake, which is nearly circular, is nearly three-quarters of a mile in diameter, and the fresh one about the same; probably more. In the depths of the centre is yellow mud, then a margin of dark sand, and nearer the cliff gravel and stones. The cliffs rise to a height of 600 feet at an angle of nearly 80°. The distance from the entrance of the lake in 8 fathoms, to the outer reef in 10 fathoms, is only 2¼ cables, or about 1400 feet, a little more than one-fifth of a mile—to excavate which with a dredge through sand and *dead* coral would form one of the finest natural docks in the world. The issue of fresh water from the lake would suffice to keep the canal clear by preventing the coral from building there, as polyps never construct their walls where there is a run of fresh water.

The men are usually clothed in tight jackets and embroidered trowsers; the sarong and deadly kris, sometimes carrying a spear, and in each chief's house were seen two or three flint muskets. The women in loose trowsers, occasionally a scarf around their waists and thrown loosely under the arms across the bosom; their hair knotted loosely on the side of the head, and, on all occasions, fled from their huts on our approach. I fancy they were desired to do so by the men.

The men fish, while the women do all laborious work, such as carrying water, pounding rice, &c. We found them very friendly all round the island, constantly coming on board, and accompanying us when on shore, and very useful as guides (for a trifle) in cutting down trees and clearing away bushes.

Their huts, which are reached by a bamboo ladder, are very uncleanly; no chairs, no table, one universal bed, covered with gaudy mats (which they make very neatly) for the chief and his harem, and several smaller ones for his followers and their wives; *all*, however—cats, poultry, dogs, babies—crawl about on a bamboo flooring, through which the dirt falls in a state of filth. No pigs; they are Mahometans.

On one of the prominent points was a chief's tomb, surrounded with loose stones to the height of 4 feet, a wooden frame north and south in the centre, with a carved log of wood at the head; a few shells thrown inside; around were some bamboos, which once had streamers on them; and although Tanglema, the chief, was born on the island, he could not tell who was buried there. I do not think he knew it was even there. The point chosen was a very pretty and picturesque one.

In general they bury their dead in their gardens, with a simple mound, and a foot and head slab, without any device or inscription.

The climate is healthy, and the soil fertile; in the north-east monsoon cool, but bringing heavy showers of rain, sometimes lasting all day or night, the temperature on an average 78°. Thunder, lightning, and heavy clouds from in the south-east over Borneo, and, working up to windward, fall over Cagayan Sulu as heavy rains.

There are safe anchorages around the island in both monsoons; that in the north-east is safe and good on the south-west side in from 8 to 10 fathoms; another good anchorage on the south-west side of Keenaponsau in 10 fathoms; a third about a mile south of the little islet at the entrance to the crater on the south-east side in 12 fathoms—but all coral bottom.

The water on the east side of the island is the deepest, having 240 fathoms 1 mile off the land, and strong tide rips around here often frighten the mariner; but they are about the deepest water.

The south-east side of the island is by far the most picturesque and interesting, but not the best anchorage; the land here slopes to the south, is

richly wooded, and many parts cleared, having plantations of bananas and sweet potatoes; but no dwellings were visible from the ship, nor did any natives visit us, as they so readily did at the south-west end on our first arrival.

I do not know any island I have seen over the world more favourably situated for trade, or more suitably adapted for cultivation. Rice, sugar, cocoa, coffee, maize, potatoes, and vegetables, would all grow if cultivated.* The soil is excellent, rich, of trap formation, with sufficient sand to make it loose and friable. Cattle of all sorts—horses, cows, sheep, pigs, and poultry—would fatten and thrive here. Enterprising men, with some Chinese labourers, would soon make it a valuable island, and not a disagreeable one, to live on.

February 11, 1871.

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3. *Route of* Ibrahim Khan *from Kashmir through Yassin to Yarkand in* 1870.

The following is the itinerary of the native assistant-explorer who was engaged to co-operate with the expedition of Mr. T. D. Forsyth, in 1870, by taking a westerly route from Kashmir to Yarkand, whilst the leader, accompanied by Mr. R. B. Shaw, proceeded from Leh *viâ* Chang-chenmo and Shadula. It is here printed from the Report received from the India Office.†

"The distance from Srinagar to Bhindpoora is 12 kos. There are a few huts in the place, from which provisions can be obtained.

"The distance from Bhindpoora to Tragbal is 5 kos. The encamping-ground at this place is on an eminence, where there is a small tank, and a little house for a couple of dak runners. Beasts of burden stop here in the hot season. Nothing else can be obtained in the place excepting grass, fuel, and water. It has a jungly appearance about it.

"The distance from Tragbal to Zerkooza is 5 kos. The road for about a kos is up-hill, and then it is down-hill. There is snow on the hill in winter, when the road gets blocked up. By the month of April it gets cleared again. Zerkooza is also a jungly-looking place. The next halting-place is Kazalwan, at the distance of 5 kos from Zerkooza. The portion of the road through the pass and along the bank of rivulet is pretty good. Across the bridge, on the bank of the river‡ flowing to Mozufferabad, there is a plain. Kazalwan itself is situate on an eminence. Grass, fuel, and water can be found in abundance at the place; milk, fowls, and goats can also be got, but no flour. It is a cold place.

"The distance from Kazalwan to Gorez is 6 kos. After crossing a bridge, the road all along keeps along the bank of a river. For about half a mile there is ascent and descent.

"From Gorez to Banglabal the distance is 5 kos, and from Banglabhul to Bishbaru the distance is 3 kos. The horsemen have sometimes to go along one side of the river, and sometimes along the other side. At each of these places there is a house for the dak runners. Besides grass, fuel, and water, nothing else can be obtained in these jungly places. About the middle of July, when the snow melts down, a short straight road opens from Banglabal to Astór, and provisions are generally sent from Kashmere to Astór Fort by this road.

"From Bishbaree to Munabad 3 kos, and from Munabad to Burjpeer 6 kos.

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* Cotton-tree and tobacco-leaf were already growing there.

† Both the translation and the transcription of Ibrahim Khan's Report have been so neglected that, even after no little trouble has been taken to correct these extracts, several passages remain almost unintelligible.

‡ *The Kishengunga.*

The road along the Mozufferabad River is pretty good. Both these places are jungly looking, and devoid of human habitation, and nothing besides grass, fuel, and water can be got in these places.

"Halt, on account of rain and snow.

"From Burj to Chul 6 kos; from Chul to Das 3 kos. The road over Burjpeer is up-hill and down-hill. The Burjpeer hill, though not very high, is covered all over with snow. Travelling across the hill immediately after sunrise one is sure to get sore eyes from the glare of the snow. The water from one side of the hill forms into a stream, about half the size of the Mozufferabad River, and the stream eventually joins the river; and the water from the other side of the hill flows into the stream coming down from the Nanga Mountains, which stream eventually flows into the Indus. Chul is a jungly-looking place, where the dak runners sometimes stop. The road over the hill gets clear of snow by the month of August, when it becomes passable for horsemen. At Das only grass, fuel, and water can be obtained, but no flour.

"From Das to Khurmand 3 kos; from Khurmand to Kodai 3 kos. The road all the way is very good. In each of these places there are a couple of houses, and grass, fuel, and water can be got in abundance. From each of these places there is a road to Askrood.

"From Kodai to Nagnoo 4 kos; from Nagnoo to Astór Fort 6 kos. The road is good. After ascending a hillock, you come to the village of Nagnoo, and then going up another hill, you come to the village of Phutnee; after which the descent is tiresome. The waters of Nanga Parbat and Burjpeer join and form a river, which is crossed by a bridge, on which there is a guard. Across the bridge on the opposite side is the Astór Fort, in which there is a detachment of men stationed. At Astór only the Government officials and European travellers can obtain supplies from the Government store through the Thanadar. In the month of September, a straight road opens from the Astór Fort to Gorez *viâ* Banglabal.

"Halt, to obtain a passport.

"From Astór to Paree 3 kos; from Paree to Archoo 3 kos. The road is good. There is ascent and descent only over two hillocks. Paree is situated on the river which comes down from Astór. It has the appearance of a jungle. There are six or seven houses at Archoo, and ghee fowls, grass, and fuel can be obtained at the place.

"From Archoo to Dakshan 3 kos; from Dakshan to Tirphalee 5 kos; and from Tirphalee to Dhoyan 3 kos. The road up to Dakshan lies over a hill. Milk, and other provisions, besides flour and rice, can be got at Dakshan. The road to Tirphalee is also over a hill. There is a house at the place, and excepting grass, fuel, and water, nothing else can be got at Tirphalee. The road to Dhoyan is of the same description. Some soldiers are stationed at Dhoyan. None excepting Government officials can get supplies at this place. Grass, fuel, and water, are to be found in abundance.

"From Dhoyan to Shatemarah 9 kos. Atoo Peer, situated on the top of a hill, is at the distance of 2 kos from Dhoyan. From Atoo Peer the road for 7 kos is a very tiresome descent. Water is nowhere available on the road, and travellers have to carry water with them in dry pumpkin-shells. Those who are acquainted with all the localities can, however, procure ice and water from a spring on the west of the hill. The bridge on the river coming down from Istoor is called Shatemarah, and there are guards on either side of the bridge, who require the travellers from either direction to show their purwanahs (passports). At the distance of a mile from the bridge the river joins the Indus. Nothing besides grass, fuel, and water can be obtained here.

"From Shatemarah to Bonji 5 kos; from Bonji to Dhat Sahee 4 kos. At the distance of a mile from the last halting-place, there is a stream on the way. No one can cross this stream after nightfall, as from evening till *morning* the current is exceedingly strong. The rest of the road is through

pretty level ground. The Bonji Fort stands on the Indus, and Government officials and European travellers can get supplies from the Government store. We crossed the river in a boat, and had to show the passport which we obtained from the officer in charge of the Bonji Fort. Near the village of Sahee we crossed a large stream by a bridge. At Sahee supplies and fodder can be obtained in abundance. A few soldiers are stationed in a castle on the opposite bank of the river from Sahee.

"From Sahee to Chakerkot 4 kos; from Chakerkot to the summit of the Niladheeree hill 7 kos. The portion of the road along the river is pretty good. A few travellers can get supplies at Chakerkot. After crossing the river by a bridge, you have to ascend the Niladheeree hill, and the ascent is pretty hard. No water can be obtained for nearly 14 kos, and people have to carry water with them from Chakerkot and Manoor. The descent of the hill is most tiresome.

"From Niladheeree to Manoor 6 kos, from Manoor to Gilghit 6 kos. Going down a pretty steep descent, you meet with little villages here and there, and good road. Gilghit has about a hundred dwellings, and supplies can be obtained from the Gilghit Fort. The dwellings are apart from each other, on separate plots of ground. There are no shops at Gilghit. Mulik Aman of Maghrool, who has taken service with the Maharajah, stops here, and he has also sent a hostage to the Kashmere Court.

"Halt, to obtain a passport.

"From Gilghit to Sharoot 12 kos. A portion of the road lies along the stream coming down from Yassin. The road through the pass is partly over hills, and partly along the banks of the stream. The part of the road near the bank of the river is pretty good for horses in winter, but it gets bad in summer. Provisions can be obtained at Sharoot in exchange for cloths. Grass and fuel are to be had in abundance.

"From Sharoot to Seengal 11 kos. At the distance of 3 kos from Sharoot, on the opposite bank of the river, there is a castle called Sher Killa, occupied by Rajah Esa Bahader and a hundred soldiers. After crossing the bridge the travellers have to deliver their passports to the Rajah. The road to Seengal then lies over two steep hills. Provisions can be obtained at Seengal in exchange for clothes, tobacco, salt, and snuff. It is easy for horsemen to ford the river in winter, but it is difficult to do so in summer. A relative of Rajah Esa Bahader is a hostage in the Kashmere Court.

"From Seengal to Ghakooch 6 miles. You cross the stream which comes down from Darail by a bridge, and then the road, which leads over a hillock up to Ghakooch, is pretty good. Ghakooch is the last village on the confines of the territories of the Rajah of Kashmere. Afyat Khan, the Rajah of the place, and son-in-law of Rajah Esa Bahader, allows people to pass on to Yassin if they can show a passport from Rajah Esa Bahader. The inhabitants of the village remain inside the fort for fear of the people of Yassin.

"From Ghakooch to Rahooshan 15 kos. In summer, in consequence of the enlargement of the bed of the river, travellers on foot are obliged to travel through stony hills. In winter, when the river becomes narrow, horsemen can go along its banks sometimes on one side and sometimes on another. The zemindars come and stop in the fort to guard the frontier. Only a few men can obtain supplies here in exchange for cloths, as the people do not value money. Grass, fuel, and water, can be got in abundance. The proper road from Rahooshan to Yassin is across the bridge, but we had by mistake gone to Khaleetan. This village, like Ghakooch, is watched by a guard.

"From Rahooshan to Khaleetan 8 kos. The road is pretty good. There are a number of small streams on the way. At the middle of the road the river from Yassin joins the river from Gazur. The road to Khaleetan is across the bridge, over the river coming down from Gazur. Provisions can be got here in exchange for cloths. Grass, fuel, and fruits are plentiful. In the course of

ten or eleven days one can visit Gazur, Thungur, Roshoo, Kalum and Khoonee, from Rahooshan.

"From Khaleetan to Yassin 8 kos. There is a way for horses, but the road lies over steep hills. Meer Walee Khan [the murderer of Hayward] resides here. He has a house inside the Yassin Fort. The fort is built of stones and mud. To the east of the fort there are four houses of peasants.

"Halt.

"The Rajah has about 20 or 25 men with him, but they are not all supplied with arms.

"From Yassin to Oomast the road is pretty good. We had to cross the two streams, formed out of the water of the Yassin River, which issues from the two passes on the west. There are little villages here and there, and provisions can be got in exchange for clothes. Yassin River becomes frozen in winter. In winter there is an easy road from Yassin to Gilghit, and horses which are shod can go this road with loads.

"From Oomast to the summit of the Darkôt hill 8 kos. There is a village also by the name of Darkôt on the way. The Yassin River issues from this hill. After wading through water in many places we crossed a bridge, and then went up the ascent of the Darkôt hill, which was pretty steep. In summer the slave merchants go to Yassin this way. From Darkôt to Kotal (the pass) it is 3 kos. On the Kotal Mountains nothing can be seen besides snow and stones; on the skirts of the mountains, however, grass and fuel are plentiful. Kotal is situate on the northern confines of the Yassin territory.

"From Kotal Darkôt to Banda Baroghal, belonging to Wakhan, under the Punjah-chief, 8 kos. For 4 kos the road lies over snow. This snow never melts, and there are fissures in the snow 180 feet deep, and horsemen travelling without a guide run the risk of falling into them.* The road remains open from June to September. The waters from the south side of Kotal flow towards Yassin, and the waters from the north side flow into the Chitral River. After crossing a stream coming down from the eastern mountains, and flowing towards Chitral, by a bridge, you come to Banda Baroghal. Provisions can be got here in exchange for cloths. A wuzeer of Meer Fatteh Ali Shah, Punjah-wala, resides in this place; and there is another man who acts both as a lumberdar and choukidar. These men are stationed here to guard the frontier, and to execute the orders of Meer Fatteh Ali Shah. They have no soldiers with them. In summer a hundred and fifty men can at any time be assembled here from localities within 7 kos from the place. The people here reside in their villages in the winter, and in summer they go out into the mountains and pastures, where they put up temporary houses. Their winter homes they call Kishlaks, and their summer homes they call Eelaks. The travellers to Yarkand go straight to the Kishlaks (villages), at the Sarhad-Wakhan, at the distance of 6 kos from this place, and then crossing the river Pamir† they go to Lungur. The travellers to Badakshan do not cross this river, but go straight to Punjah along the bank of the river. Grass, fuel, and water, are plentiful in this place.

"From Baroghal to the 'Kishlaks of peasants' [Kishlak-i-Dihkánán] 11 kos. The road through the pass, along the bank of the river coming down from Pamir, is pretty good. The villages consist of five or six scattered houses. In summer the peasants leave behind one of their number to watch their crops, and the rest go to the Eelak. In some villages scanty supplies and conveyances can be obtained in exchange for cloth.

"From the Kishlaks to Baba Tungee 10 kos. The road lies over hills, and

* A glacier is evidently crossed here.

† What is here called the Pamir River is the southern of the two streams forming the Upper Oxus, or Panja, and is that called by Wood the Sarhad or *Mastúch* River.—[NOTE BY COL. H. YULE.]

through valleys along the bank of the river. In winter, when the water of the river becomes less, the road widens. Provisions and conveyances can be obtained here in exchange for kirpás, cloth, vessels, and clothes. The current coins here are the Mohummad Shahee. Grass and fuel are plentiful.

"From Baba Tungee to Punjah—the residence of Meer Fatteh Ali Shah, ruler of Wakhan—14 kos. The road is over a few hillocks and across some streams, and leads between Yarkand and Badakshan. It remains open in all seasons. The climate of this place is as cold as that of Yassin and Gorez. The river which comes down from Pamir flows under the fort where Meer Fatteh Ali Shah resides. No highway robbery or theft is committed in the Wakhan territory. Supplies can be easily obtained. Meer Fatteh Ali Shah has ten or twelve horsemen with him in the fort. There are no shops in the place. Merchants have to pay a tax of 2 rupees per each horse load.

"We went back to Baba Tungee.

"We came to the desert in front of the villages of peasants (Deh Dihkanan).

"We came back 3 kos from Deh Dihkanan, and stopped in the *Kishlak* (Kishlak-Sarhad-Wakhan) on the confines of Wakhan, where we bought some flour. Provisions and carriage can be obtained in this place in exchange for cloth and vessels. We arrived at this village by crossing a river. A road opens from this place in winter, along the bank of the river, and as the river gets frozen it can be crossed by shod horses. One travelling from Yassin to Yarkand has to come straight to this place from Baroghal.

"From the Kishlak-Sarhad-Wakhan to the middle of the desert,* 8 kos. In summer the road lies over the hill of Sarhad-Wakhan, and over some hillocks on the side of the river. The travellers have to stop somewhere near the river. There is a little bridge on the way about 6 kos from Sarhad-Wakhan, which is kept in repair by the people of Wakhan. It seems they cannot get timber sufficiently long to lay across the bridge. About a hundred horsemen can be supplied with grass and fuel at this place. The travellers to Sarikul take provisions for six or seven days along with them from this place, as they can get them nowhere in Pamir.

"To a stream about a kos from Langar 7 kos. The road along the side of the river is pretty good. In one place only the road for about 25 yards, between the river and the hill-side, is so narrow that the merchants are obliged to take the loads off their horses and have them carried by men. Langar is now a desert. The Khirghiz used to live here formerly and rob the travellers. Grass and fuel are plentiful on the steppe here.

"To the lake called Kalsar Bam-i-Dunya (Roof of the World) 11 kos.† On the way there is a tomb of a caravan traveller, and a few deserted houses of the Khirghiz. Further on there is a good road to Sarikul. There is also another road to Sarikul along the river, which is a long one, and over a hill covered with snow. There is also a road from Wakhan to Kanjoot. The river, which issues from the Kanjoot hills, keeps along the road to Sarikul. The pass through Pamir is half-a-mile wide. Kalsar Lake is a mile wide and three miles long. The waters from the hills on both sides flow into it. In summer the place is colder than Wakhan on account of the wind blowing. A small stream issues from the lake towards the north, and flows towards Shaghnan. The place is a desert. In April and June the wild ducks lay their eggs on the banks of the lake. Snow begins to fall in Mágha (January–February), when some travellers prefer going over the Jamistan Mountains on the west of the lake.

"To the banks of the stream issuing from the Kalsar Lake 12 kos. The road is through level ground, sometimes over marshy land. The place is a

* No doubt a *quasi* proper name, "Miyan-i-Biyábán," or the like.—[H. Y.]

† This lake is the Pamir Kul, or Barkal Yasin of Major Montgomerie's Mirza.—[H. Y.]

desert. The horns of wild goats are seen scattered over the place by hundreds, which is owing to the murrain which breaks out among them, and kills them by hundreds. Since the accession of Meer Atalik Ghazi, ruler of Yarkand, no highway robbery is committed in the desert. The Khirghiz have scattered, and Pamir lies uninhabited.

"To the banks of the stream in the pass 6 kos. The travellers cross the river coming down from Shanan [?], near a deserted house of the Khirghiz, where the river is fordable. The road is pretty good, through marshy land. Grass and water are plentiful, but it is difficult collecting fuel.

"To Sarikul Fort, on the borders of Yarkand Territory, otherwise called Tash Kurgan, 14 kos. The road through the pass is pretty good, and lies over a ridge. For about 4 kos up to Sarikul the road is tiresome, as it lies sometimes on one side and sometimes on the other side of the stream, and the horses stumble on the stones. This pass, also, is deserted by the Khirghiz. The entrance to the pass is guarded by sawars. The Sarikul Fort was built in the days of King Sipras [? Afrasiab]; it is now in the possession of the ruler of Yarkand. An officer with a force of some men is stationed here, to whom we reported our arrival.

"Stopped here by order of the officer.

"This district is called Tash Kurgan; there are about 300 men in the fort. The bastions of the fort are high, but it is built of stones and mud, and could easily be breached.

"To the middle of the pass in the desert 7 kos. The road is pretty good. The sawars guarding the pass require the travellers to show their passports before they allow them to go.

"To Dera-Khirghiz 9 kos. The road is pretty good, and lies over two ridges. The Khirghiz have half-a-dozen houses here. They keep cattle, and subsist on the cheese they make out of the milk of their sheep and goats. They do not use any grain. Grass and fuel are plentiful. Provisions other than grain, and carriage, can be obtained in exchange for kirpas, vessels and false pearls.

"To the banks of a stream in the desert 4 kos. There is a road for travellers on foot along the banks of the river through the pass, but it is not a convenient road for beasts of burden, and merchants therefore go across a little hill on the side of another stream. Nothing besides grass and fuel can be got in this place.

"To the dwellings of the Khirghiz 13 kos. The road lies over two hills, and is on the whole pretty good. Grass and conveyances can be obtained here. After descending the first hill you meet another direct road to Yarkand through the pass, which is called the Tangee road.

"To the desert where the Khirghiz* raise grain 14 kos. The road is pretty good. Besides the dwellings of the Khirghiz there is a house of the Lumberdar of the Khirghiz in the place. The Khirghiz, through fear of the King, do not molest the traveller.

"To the Kishlak, near Yangi Hissar, 14 kos. The road is pretty good, and is through little hamlets. At one place the road is through a fort called Kurawal. Here at the time of the Chinese a pass was cut out to serve as an entrance.

"To Yangi Hissar 4 kos. Here we reported our arrival in writing to Mohammud Akal Khan Sahib Turra, officer in charge of the castle.

"We had to halt here for three days, *i. e.*, up to 1st August, 1870, by order of the officer, and received our travelling expenses and means of carriage from Government.

"We arrived at Yarkand along with a sawar sent with us from Yangi Hissar.

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* This expression and that in the preceding paragraph, "dwellings of the Kirghiz," are again evidently *quasi* proper names of halting-stations.—[H. Y.]

4. *Note on the Ruins in Samarcand, from* Fedchenko's *Description of the Valley of the Zerafshan*, 1869.

(Communicated by Robert Michell.)

The monuments of Samarcand are all of a religious character; they are either Mesjids or tombs. Their foundations, judging by their remains, were laid by Timur. There are no ruins in the city of a character more ancient than these.

In the centre of the city, separated from each other by a wide plain, stand three Medressés. The one against the western horizon is called Ulugh-Bek, after Timur's nephew, the well-known astronomer, who built it; the one on the east side of the plain is Shir-dar; the third, standing between the two first, is Tilla-kari. The interior arrangement is the same in all three, and is similar to that of large Medressés generally. It consists of a large quadrangular court, surrounded by a range of two-storied buildings, with chambers occupied by teachers and pupils. The Mesjid or house of prayer, is on the side facing towards Mecca. The Mesjid particularly noted for the decorative art lavished upon it is the one in the Tilla-kari; its walls are covered with handsome paintings. The wall of the niche where the Imaum (or the image called Mikhrap, which presents itself to the Moslem mind in prayer) is supposed to be, is gilded over, and bears the inscription: "There is no God but God, and Mahomet is his Prophet."

The Shir-dar Medressé is so called because of the two gigantic figures adorning the front of the building, which M. de Khanikof took for lions. These figures are made of coloured glazed bricks. Time has had considerable effect upon them, yet it has not quite obliterated their character.

The devices in variegated glazed tiles on the outer walls of these edifices lend them a peculiar originality and beauty, adding to the effect of the odd style of architecture. The arches are bold, the minarets gigantic. The inscription on the walls of Shir-dar, which is in verse, and in honour of Jelengtash, the builder, affirms that the Moon placed the finger of astonishment on her lips on beholding these splendid edifices.

These three Medressés were built after Timur's time. The Ulugh-Bek was built in the year of the Prophet 822, or 464 years ago, and the two others were completed in 1028, *i.e.* A.D. 1612.

Besides these, there are in Samarcand six other buildings of antiquity, dating from Timur's time. These are, Shah-Zinda, Bihi-Khanym, Gur-Emir, Ak-Serai, Ishrat-khana and Bihi-Khanym-Gur-Khana. Of these the best preserved are Gur-Emir, where the great Emir was buried, and Shah-Zinda.

The Shah-Zinda is outside the town, a little more than a mile from the gates of the same name on the Tashkend road. The gateway opens upon the road; inside this a flight of 37 steps leads up to a long open gallery, flanked by two elevated chambers, capped with cupolas, conducting to the principal Mesjid. Here, behind an iron screen, fastened with a padlock in the shape of a fish—the emblem of silence—is a monument in honour of Shah-Zinda. Lehmann, Khanikof, and Vámbéry, have said that the Shah-Zinda was the summer palace of Timur, whither he used to resort for pleasure and recreation. M. Fedchenko is of a different opinion. He does not believe that the building could have been devoted to pleasure; it was erected in a cemetery, and is even now surrounded by ancient tombs. There are no habitable chambers in the Shah-Zinda; the rooms are either Mesjids or receptacles for the remains of the wives, children, and relatives of Timur. The following legend is related by the Mollahs of the place concerning the raising of the building and the fish-shaped padlock: A thousand years ago

there dwelt a Saint, whose name was Hazret-i-Shah-Zinda. He one day dug a pit, and disappeared in it, saying he would live there eternally. Time fled, but there were unmistakeable signs of the continued existence of the Saint. Timur, being greatly moved by this extraordinary circumstance, wished to be convinced of the miracular preservation of the holy man, and therefore caused several people to be let down into the pit. But not one of these men returned again to the top, much to Timur's consternation, and to the increase of his curiosity and awe. At last one man volunteered to descend, directing, however, that he should be lowered head foremost, "because," he said, "it is not respectful to go down feet foremost to the Saint." It was, he thought, because all the others had done so that they had not reappeared. When this man reached the bottom of the pit, he found the Saint in prayer, and was so struck by his appearance, that he fainted, remaining senseless for three days. When he recovered, the Saint said to him, "It is well! Thou art evidently a God-fearing man; but beware lest thou speakest of that that thou hast beheld. If thou utterest a word of what thou hast seen, thou and thy children unto the eighth generation shall surely be dumb." The man was brought back to the earth's surface. On being pressed by Timur for an account of what he had seen, he at first refused to give it; but on being threatened with death he told all; and it came to pass that the man was struck dumb. Timur, in the interest of the poor man, for whose sin he was himself answerable, prayed fervently to the Saint, and to propitiate the latter, erected in honour of him the splendid edifice called the Shah-Zinda. Nevertheless, says the legend, that man and his children unto the eighth generation, were all dumb.

The Bihi-Khana Medressé was built in the year 787 by the wife of Timur, a Chinese princess, whose name it bears. It is now in a very dilapidated state; the magnificent arch over what was once the principal entrance, and the immense dome of the Mesjid have almost entirely crumbled away. The stones still continue to give way, and to fall when an earthquake is felt. The people of Samarcand no longer regard it as a holy place, but look upon it simply as a ruin, the court-yard within being given up to keepers of arbas and horses. Bihi-Khanym lies buried in an adjoining octagonal building, called Bihi-Khanym-Gur-Khana.

Timur lies interred in a building called Gur-Emir *i. e.* the tomb of the Emir. This is a quadrangular structure, surmounted by a large dome. The surrounding arches and the tall minaret have crumbled away, with the exception of one arch and a single minaret. The interior is reached through a dark corridor, where, behind an iron screen, are several tombstones. Under the nearest stone lies Mir-Saïd-Banak, Timur's preceptor and friend. The entire building was raised by Timur over Saïd's remains in 762, long before his own death. Timur died in Otrar, within 400 miles of Samarcand, but his body, according to his own directions, was laid by the side of that of his preceptor. The stone over Timur's grave is covered with inscriptions; it is a dark green jasper, while all the others are either marble or plain alabaster. By the side of Timur lies his son Mirza-Mahomed-Djanzir. At Timur's feet rests his Vizier and principal adviser, whose name no one in Samarcand is able to tell. After these come Pir-Mohamed, a relation to Timur, and Miran-Shah his son. In the mikhrab, or niche, facing Mecca, rest the remains of Saïd-Mir-Omar, son of Saïd-Mir-Kubal who was also a preceptor of Timur and who is buried in Bokhara.

By the side of Mir-Saïd-Bariak's tomb there is a small one, which is said t contain the ashes of the grandson of the latter Saint. A spiral flight of s steps leads into the crypt, where there are seven tombstones of white lim stone, of which seven are disposed in the same order as those above, bei nearly all covered with quotations from the Koran, as it is asserted. In t

eastern wall of this crypt there was once a door, through which the dead were brought in; it is now built up with bricks.

Devotees and pilgrims flock with great reverence to Timur's grave—though not in such great numbers as in former days. At one time there were four entrances into this building—signifying that people flocked from all the four quarters of the world to the tomb of the great Emir. The court was once enclosed within a wall, of which the gateways alone exist in the present day. Over each of these gateways is the following inscription in Persian characters: "Amolil-Abdulsahif Mohamed-bini Mahmud albenai."

In a long chamber on the right-hand side on entering the Gur-Emir are buried the female members of Timur's family, and on the left are the tombs of his son Mirza-Shah-Rokh and his family.

Close to the Gur-Emir there is a small building called Ak-Serai, now in ruins, and serving as a stable. Tradition says that here lie the three wives of Timur.

Ishrat-Khana is outside the town. To this place, according to tradition, Timur was wont to repair for recreation. It is now a ruin, but one may still perceive that there were small apartments in it in addition to the large central hall on the second floor. The inhabitants of Samarcand relate that Timur's favourite wife Bihi-Khanym, who caused this structure to be raised, intended that it should contain her tomb. But Timur, on paying a visit of inspection after the building was completed, was so delighted with it that he kissed his wife. Confused and pleased by this caress, Bihi-Khanym said: "Let this be Ishrat-Khan's house of gaiety and pleasure; a repository for my remains shall be built elsewhere."

There are many other ancient, though less noteworthy edifices, in and around Samarcand, but more particularly a great number of tombs holding the ashes of men held in estimation as Saints. There is an incredible number in Samarcand itself. One gentleman entering into statistical inquiry into this matter summed up as many as two hundred *auliés*, or shrines commemorative of holy men.

There is, however, one more building deserving of notice: it is not a monument of antiquity, but is, nevertheless, an object of some interest. The late Emir of Bokhara was in the habit of always passing some summer months in Samarcand, living with his harem and suite in a spacious palace now converted into a hospital, which was purposely built for him within the citadel. In one of the courts of this palace, where he held his state audiences, is the famous Kuk-tash (green-stone), which served as his throne. This is a large block of greyish marble. Many people have been astonished to find that its colour is not green, as its name signifies; the fact, however, is that, although *kuk* does mean green, *kuk tash* means simply marble.

National monuments of greater antiquity may, perhaps, be found among the ruins popularly called Afraziab in the northern outskirts of the town, which are connected in the minds of the natives of the country with the name of that mythical hero who is supposed to have fought with Alexander of Macedon. The extent of these ruins, or rather of this dreary desert, is immense. It presents a scene of scattered "kurgans," or tumuli, and of heaps of clay—the remains, probably, of former clay buildings. It is asserted by the natives that coins and other valuables are washed out of these heaps by the spring rains, but it does not appear that any curiosities have been picked up by the Russians.

"Kurgans" similar to those of Afraziab occur in various other places around Samarcand. Encircling them are very frequently to be seen traces of a wall and gateway, and in one corner of such a circle there is generally another and a higher heap of *débris*. These were doubtless strongholds, the type of which is preserved in the present style of Bokharian forts. The citadel of a town is

usually built upon a natural elevation increased by additional piles of earth, and encircled by an earth mound. The natives say that these "kurgans" are referable to a period when the people of the country lived in constant feud, and when each settlement had necessarily to be fortified. No traces of tombs or of stone buildings are observable on these mounds, therefore archæological researches in this country of clay structures can be pursued, says M. Fedchenko, only under great difficulties.

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